FEBRUARY, 1933.

GENERAL PHYSICS.

ADSORPTION.

417. Adsorption Displacement and Molecule Orientation at Active Ash-Free Carbon. E. Landt and W. Knop. *Zeits. f. phys. Chem.* 162. *Abt.A.* 4–5. *pp.* 331–345, *Nov.*, 1932.—The displacement of hydrochloric acid by a series of homologous organic compounds from an active sugar charcoal, which does not adsorb alkali, has been studied. For the simplest cases of the alcohols and the monobasic aliphatic acids, the ratio between the number of the acid molecules displaced and that of the organic compounds entering increases in proportion to the number of the carbon atoms in the molecule. This indicates that the active places of the surface which adsorb the hydrochloric acid are not specifically poisoned but are diminished in number in proportion to the diminution in surface effected by the adsorption of the organic molecules. From this assumption it follows that the carbon atoms lie flat at the surface of the charcoal. In the dicarboxylic acid series the relationships are more involved, because, in addition to the molecule adsorption, a process of ionic exchange must be considered. This holds especially for the first two members of the series, oxalic and malonic acids, for which, in the more dilute solutions, relatively high values of k are found. The behaviour of the higher homologues also indicates a flat molecule orientation. Experiments with benzoic acid point to a horizontal arrangement of the benzene ring in the charcoal surface. T. H. P.

418. Heat of Wetting of Silica Gel. R. Berthon. *Comptes Rendus*, 195. *pp.* 1019–1021, *Nov.*, 1932.—Discussion of the influence of capillary adsorption on the measurement of heats of wetting of silica gel by various liquids. A. S. C. L.

See also Abstracts 503, 504, 642.

ATOMIC AND MOLECULAR STRUCTURE.

419. Isotopic Weight of H^2. K. T. Bainbridge. *Phys. Rev.* 42. *pp.* 1–10, *Oct.* 1, 1932.—The mass of H^2 was measured on a mass spectrograph and found to be $2\cdot01351 \pm 0\cdot00018$ referred to $O^{16} = 16$. On the assumption that the nucleus is composed of two protons and one electron the energy of binding is approximately 2×10^6 electron-volts. If the H^2 nucleus is made up of one proton and one neutron the binding energy of these two particles will be $9\cdot7 \times 10^5$ electron-volts. The presence of H^1H^{2+} can introduce an error of $0\cdot00003$ mass units in the mass determination. Two samples of enriched hydrogen prepared by Brickwedde were used. From the value for the mass of H^2 the energy balance is calculated for a process of non-capture disintegration of N^{14} by a neutron impact whereby C^{12} and H^2 is produced, and it is concluded that it cannot have been observed. J. E. R. C.

420. Technique for the Separation of Gaseous Isotopes and Application to Neon. G. Hertz. *Zeits. f. Physik*, 79. 1–2. *pp.* 108–121, *Nov.* 4, 1932.—Makes use of diffusion through a porous wall in a vacuum.

The apparatus which uses 24 pumps gave with neon an alteration of the isotope ratio of eight times in a few hours. Mass spectrograms and optical spectrograms of the neon isotopes are reproduced. **Errata,** *ibid.*, 79. 9–10. p. 700, Dec. 15, 1932. J. E.

421. Semi-Classical Theory of the Chemical Bond. W. Heitler. *Zeits. f. Physik*, 79. 3–4. *pp.* 143–152, *Nov.* 14, 1932.—The quantum theory of the homopolar bond may be written as an eigenvalue problem of a Hamiltonian function of economical values. In this theory, the number of valence bonds between two atoms appears as an integral quantum magnitude similar to the number of light quanta in the Dirac theory. If the canonical variables be regarded as *c*-numbers, then a classical theory is obtained. The exchange integrals appear as dynamic quantities. General solutions are given for the entire aliphatic chemistry, wherein the bonds are simple. The energy of union is additively computed from considerations of the single valence bonds, every bond contributing the value of the exchange integral to the union. H. H. Ho.

422. Angle between the Oxygen Bonds by the Collision Area Method. W. A. Hare and E. Mack, Jr. *Am. Chem. Soc., J.* 54. *pp.* 4272–4277, *Nov.*, 1932.—The predictions of Slater [see Abstract 2501 (1931)] on the angle between the valence bonds of the oxygen atom are investigated by the shadow-graphic collision area method. The collision areas of diphenyl ether and diphenylmethane, which should be approximately the same, are found to be 36·13 and 36·40 sq. Å., respectively, and the oxygen bond angles approximately tetrahedral. The ethyl ether molecule is found to be tightly coiled; the preparation synthetically of di-tertiary butyl ether is probably impossible; the molecular volume of liquid diphenyl ether is discussed. N. M. B.

423. Supposed Allotropy of Liquid Nitrobenzene. E. Cohen and L. C. J. te Boekhorst. *K. Akad. Amsterdam, Proc.* 35. 8. *pp.* 1016–1023, 1932. *In German.*—It is established that the density-temperature curve as well as the viscosity-temperature curve of pure liquid nitrobenzene is continuous throughout the range 1–20° C. and that the supposed allotropy of Wolfke and Mazur [see Abstract 2483 (1932)] does not exist. [See also Abstracts 2288, 4414 and 5140 (1932), and 650 (1933).] H. H. Ho.

424. Silicon Hydride—Monatomic, or Triatomic Hydrogen. A. B. van Cleave and A. C. Grubb. *J. Phys. Chem.* 36. *pp.* 2817–2818, *Nov.*, 1932.—Schultze [see Abstract 1507 (1932)] has criticised a previous investigation by Grubb and co-workers [see Abstract 3329 (1931)] with so-called triatomic hydrogen which he considers was monatomic. Further experimental evidence has confirmed the original assumption of activity due to triatomic hydrogen. H. H. Ho.

See also **Abstracts 550, 556, 604, 616, 618, 620, 635, 644, 658, 659, 671, 706, 771.**

COLLOIDS.

425. Mechanical Properties and Structure of Nitrocellulose Films. A. V. Blom. *Kolloid Zeits.* 61. *pp.* 234–239; *Disc.*, 239, *Nov.*, 1932. —The load-strain curves of nitrocellulose films exhibit an elastic range in which Hooke's law is valid, a transition interval of which the beginning, *i.e.*, the elastic limit, is very ill-defined, a plastic interval, and a final interval in which plastic deformation continues, but with more rapidly increasing stress. Typical results are given for films prepared from solutions of viscosities between 0·25 and 150 sec. The breaking strength is not proportional to the viscosity, but with increase of viscosity it becomes more remote from the yield point. The modulus of elasticity of the films is $21 \cdot 3 \times 10^9$ dynes per sq. cm. The influence of plasticisers on the mechanical properties of the films is described. Determination of the breaking strength and extension does not sufficiently indicate the behaviour of nitrocellulose films; it is necessary to determine the complete load-strain diagram. H. F. G.

426. Viscose, Cellulose Acetate and Gelatin Film Technique. Marta Halama. *Kolloid Zeits.* 61. *pp.* 240–245; *Disc.*, 245–246, *Nov.*, 1932.—A general account of present-day methods of manufacture, and of the properties and applications of such films. H. F. G.

See also Abstracts 439, 446, 661, 730, 743.

CRYSTAL STRUCTURE AND PROPERTIES.

427. Madelung Constants of Cubic Crystal Lattices. J. Sherman. *Phil. Mag.* 14. *pp.* 745–746, *Nov.*, 1932.—The coulomb energy of the oxygen ions with respect to a copper ion is that of a body-centred lattice with respect to an ion at 1/4 1/4 1/4, whereas the coulomb energy of fluorine ions with respect to a calcium ion is that of a simple cubic lattice with respect to an ion at the centre of one of the cubes, and the difference between these two energies must be taken into account when evaluating the Madelung constant of the cuprite structure by means of the data for fluorite. Wheeler [see Abstract 4473 (1932)] has failed to do this, so that his value of 3·162 for cuprite should be corrected to 4·7522 as calculated by Emersleben. H. H. Ho.

428. Crystal Structure of Electrodeposits from Copper Acetate Solutions. S. J. M. Allen, H. Kersten and J. Maas. *Physics*, 3. *pp.* 169–171, *Oct.*, 1932.—It is shown by X-ray diffraction methods that electrodeposits from copper acetate solutions consist principally of a mixture of crystals of copper and cuprous oxide and that the proportion of cuprous oxide deposited with the copper increases when the bath is made less acid. Rectification or photoelectric properties such as are exhibited by cuprous oxide prepared on the surface of copper were not observed for the electrodeposits. AUTHORS.

429. Lattice Constant for Cu-Pd Mixed Crystals. J. O. Linde. *Ann. d. Physik*, 15. 3. *pp.* 249–251, *Nov.*, 1932.—Investigations on the lattice constants for the mixed crystalline series of the Cu-Pd alloy between the melting point and 700° C. are carried out. F. C. C.

430. Crystal Structure of Calcium Metaborate, CaB_2O_4. W. H. Zachariasen and G. E. Ziegler. *Zeits. f. Krist.* 83. *pp.* 354–361, *Nov.*, 1932. *In English.*—The compound is orthorhombic, with $a = 6 \cdot 19 \pm 0 \cdot 02$ Å., $b = 11 \cdot 60 \pm 0 \cdot 04$ Å., $c = 4 \cdot 28 \pm 0 \cdot 01$ Å. for the unit cell, which contains four molecules. Space group Pnca-V_h^{14}. Each Ca atom has 8 oxygen neighbours at an average distance of 2·52 Å., and each B atom is at the centre of a nearly equilateral triangle with O atoms at the corners. Endless chains parallel to crystallographic axis *c* are formed of BO_3 groups. The optical properties and cleavage are in accord with these arrangements. F. I. G. R.

431. Space-Lattice of Cadmium Sulphate $CdSO_4.\frac{8}{3}H_2O$. L. Egartner, F. Halla and E. Schwarz. *Zeits. f. Krist.* 83. *pp.* 422–425, *Nov.*, 1932.—Evidence is given and discussed leading to the probability of the space-group C_{2h}^6. The compound (according to Groth) is monoclinic-prismatic, and there is no piezoelectric effect. F. I. G. R.

432. X-Ray Investigations of Ammonium Bifluoride, NH_4HF_2. O. Hassel and N. Luzanski. *Zeits. f. Krist.*, 83. *pp.* 448–459, *Nov.*, 1932.—The substance is rhombic with cell-edges 8·14, 8·33, 3·68 Å. There are four molecules in the unit cell. Piezoelectric effect is absent, and the space-group is found to be V_h^{13}. F. I. G. R.

433. Structure of Potassium Dithionate, and Measurement of Integrated Reflection from a Small Crystal. G. V. Helwig. *Zeits. f. Krist.* 83. *pp.* 485–492, *Nov.*, 1932. *In English.*—Further examination of small crystals, a new method of measuring the integrated intensity of small crystals (described) being used, and of a large crystal completes the previous investigation [see Abstract 2949 (1931)], showing the space-group of potassium dithionate to be definitely D_3^2 [see G. Hägg, Abstract 4767 (1932)]. A satisfactory structure similar to but showing higher symmetry than that proposed by Huggins and Frank (see *J. Min. Soc. Amer.*, 16. p. 580 (1931) is deduced. C. A. S.

434. Inclusion of Small Amounts of Lead in Alkali Halides. H. Käding. *Zeits. f. phys. Chem.* 162. *Abt.A.* 3. *pp.* 174–186, *Nov.*, 1932. —On crystallisation of NaCl, KCl and KBr from aqueous solutions containing very small amounts of lead (about 10^{-19} gm.), a great part of the lead is found in the precipitate, its distribution between crystal and solution being as with true mixed-crystals systems; with larger quantities of lead in the solution, the mixed series breaks off at different points for the three salts. The precipitated lead is not present as lead kation in the precipitate, but as a negatively charged complex ion. The lead is precipitated only with halides having the rock-salt lattice, so that the hydrated halides, NaCl, $2H_2O$ and NaBr, $2H_2O$ include no lead in their lattice. T. H. P.

435. X-Ray Analysis of Iron Pyrites by Fourier Series. H. M. Parker and W. J. Whitehouse. *Phil. Mag.* 14. *pp.* 939–961, *Nov.*, 1932. *Supplement.*—An account is given of an analysis of iron pyrites by a double Fourier series, which verifies in an experimental case the deductions of Bragg and West [see Abstract 1083 (1931)] from their ideal crystal. The lattice spacing of iron pyrites and the parameter of the sulphur atoms are accurately determined. Some evidence is obtained for the view that the pyrites structure is based on homopolar binding. J. T.

436. X-Ray Investigation of a Case of Chromoisomerism. E. Hertel and G. H. Römer. *Zeits. f. phys. Chem.* 19. *Abt.B.* 4. *pp.* 228–230, *Nov.*, 1932.—In the monoclinic crystal lattice (space group C_{2h}^5, the molecules of the yellow modification of 4-nitro-2-methylaminotoluene follow in identical position at distances of 3·83 Å. along the *c*-axis, whereby the ring planes fall into the plane (00*l*). In the triclinic crystal lattice, the molecules of the red modification follow along the *c*-axis at the half distance of the identity period in non-identical position. The red colour of this

modification is ascribed to monomolar molecular-compound formation. [See also Abstract 4779 (1932) for results with stilbene derivatives.]
H. H. Ho.

437. Alteration in Structure of Crystalline Salts of Long-Chain Fatty Acids at the Melting Points of the Parent Substances. P. A. Thiessen and Eva Ehrlich. *Zeits. f. phys. Chem.* 19. *Abt.B.* 4. *pp.* 299–302, *Nov.*, 1932.—Alterations in the characteristic properties of the sodium salts of long-chain fatty acids are observed at the melting points of the fatty acids to which the salts correspond. The temperature in each case is well below the melting point of the salt itself. It is found that the cooling curve shows a discontinuity, the extension coefficient shows a sudden change, and the space-lattice partially collapses at the temperature in question. J. T.

438. Methods for Determination of Crystallo-Morphological Constants. G. Kalb. *Zeits. f. Krist.* 83. *pp.* 362–373, *Nov.*, 1932.—A discussion, based on a number of examples, of how measurements concerning crystal morphology can be carried out on vicinal surfaces. It appears that no general method exists, and the use of mean values is rejected. F. I. G. R.

439. Crystalline Threads and Fibrous Forms of Aggregation. H. W. Kohlschütter. *Kolloid Zeits.* 61. *pp.* 270–278; *Disc.*, 278–280, *Nov.*, 1932.—A review, illustrated by many diagrams, of the forms assumed by common substances, mostly minerals, tabulated as tabular, needle-shaped, lamina, etc. The discussion deals with the relation of crystal morphology to internal structure. F. I. G. R.

440. Optical Properties of Carbonates. H. Brasseur. *Zeits. f. Krist.* 83. *pp.* 493–495, *Nov.*, 1932. *In French.*—By attributing to the CO_3 group two ionic refractivities according as the electric vector of the light wave is parallel or perpendicular to the plane of the group, the relative positions of CO_3 groups in carbonates of unknown structure can be deduced from their refractive indices if it is assumed that the form and size of the CO_3 group are invariable and that the ionic refractivities of any other groups present are independent of their orientation to the electric vector. A number of results obtained on this basis are tabulated. C. B. A.

441. Dissociation-Heat of the Lead Lattice. G. v. Hevesy, W. Seith and A. Keil. *Zeits. f. Physik*, 79. 3–4. *pp.* 197–202, *Nov.* 14, 1932. —This quantity amounts to 27,830 cal./mol., and is, like the constant A in the diffusion equation, dependent upon structure. F. I. G. R.

442. X-Ray Apparatus for Investigation of Microscopic Crystals. O. Kratky and K. Eckling. *Zeits. f. phys. Chem.* 19. *Abt.B.* 4. *pp.* 272–290, *Nov.*, 1932.—A connected account is given of the apparatus (camera, with goniometer head, etc.) previously described [see Abstracts 3157 (1930) and 1925 (1931), and *Zeits. f. Krist.*, 1931, 76. p. 517] and of the method of working, embodying certain improvements. In particular the divergence of the sides of the stop is reduced to 10°, and a more accurate method of determining the distance from crystal to film is described. C. A. S.

443. Quantitative Crystalline Analysis by X-Rays. M. E. Nahmias. *Zeits. f. Krist.* 83. *pp.* 329–339, *Nov.*, 1932. *In French.*—The paper refers to methods that have been used for determining the percentage of a crystalline substance present in a mixture containing two or three crystalline constituents, and indicates the errors and difficulties involved. A new method which avoids numerous sources of error is described, and examples are given of its application to the determination of the percentage of quartz in artificial mixtures and in an earth. W. E. P.

444. Corrections for Debye-Scherrer X-Ray Photographs. Z. Nishiyama. *Tohoku Univ. Sci. Reports,* 21. *pp.* 364–384, *Oct.,* 1932. *In English. Report No.* 293 *from the Research Inst. for Iron, Steel and other Metals.*—Debye-Scherrer X-ray photographs of iron and aluminium specimens of various diameters were taken in order to study the methods of correction for the thickness of the specimen. The various correction formulæ that have been proposed are discussed. It is claimed that for metals which have a large absorption the correction formula proposed by the author agrees more satisfactorily with the experimental results than do other formulæ. The experiment confirms that the method of extrapolation to $2\theta = 180°$ is applicable to the calculation of the lattice constant. W. E. P.

See also Abstracts 452, 453, 649, 669, 719, 720, 723, 779.

DENSITY.

See Abstracts 423, 645, 650, 671, 736.

DIFFUSION AND OSMOSIS.

445. Experimental Study of Negative Osmosis. A. Grollman and K. Söllner. *Am. Electrochem. Soc., Trans.* 61. *pp.* 477–484; *Disc.,* 485, 1932.—Negative osmosis is the term applied to the flow of a liquid through a membrane from a more concentrated to a more dilute solution. Methods are given for the deposition of membranes in cells of clay or other porous materials, the cells thus prepared showing this anomalous behaviour. When such cells, filled with water, are placed in 0·1 molar lithium nitrate solution, negative osmotic pressures as high as 300 mm. of water are observed. In the *Discussion,* **Kahlenberg** stated that he drew attention to this phenomenon in 1926, and objects to the use of the expression " negative osmosis." T. H. P.

446. Mechanism of Anomalous Osmosis. A. Grollman and K. Söllner. *Am. Electrochem. Soc., Trans.* 61. *pp.* 487–497, 1932.—It is unlikely that, in such substances as clay cells or collodion membranes, anything approaching homogeneity of the constituent parts of the membrane is attained. The membrane must be regarded as an aggregate of a number of pores of different sizes, the summation of the properties of which is measured in investigations on permeability, diffusion rates, conductivity and dynamic membrane potentials. These considerations are made the basis of a new theory devised to explain the phenomenon of anomalous osmosis, which is ascribed to the interaction of contiguous pores of different sizes. Certain pores give rise to a potential which in turn produces an electroendosmotic flow through other pores. Deductions from this theory are in accord with experimental results. [See also Abstract 3268 (1930).] T. H. P.

See also Abstracts 420, 441, 643, 665, 741.

ELASTICITY AND PLASTICITY.

447. Bonded Elasticity and its Mathematical Schematisation. E. Volterra. *Accad. Lincei, Atti,* 16. *pp.* 220–222, *Sept.,* 1932.—Introduces a new method of treating the deformations of elastic solids. The method is based on the special hypothesis that in many cases the displacements of elastic bodies take place as if there existed special internal bonds. This simplifies the analysis and gives results which are very approximately accurate. A. D.

448. Static Theory of Plane Arches of Great Curvature. C. L. Ricci. *Accad. d'Italia, Mem.* 3. 1. *pp.* 5–18, 1932.—Endeavours to complete the approximate statical theory of plane elastic arches of great curvature and constant section, strained by forces within the plane of the geometrical axis of curvature. Determines the tangential tensions in the transverse sections and shows that, if the radius of curvature of the geometrical axis varies from one point to another, the tangential tensions depend also upon the bending moment and upon the radius of curvature of the evolute of the geometrical axis. E. E. F. d'A.

449. Stresses in Terms of Harmonic Functions. P. Papcovitch. *Comptes Rendus,* 195. *pp.* 754–756, *Nov.* 7, 1932.—Continuing previous work [see Abstract 4752 (1932)], expressions are obtained for the stresses in an elastic material, in terms of elastic moduli, and four arbitrary harmonic functions of the strains. J. P. A.

450. Equilibrium of an Elastic Cylinder. B. Galerkin. *Comptes Rendus,* 195. *pp.* 858–860, *Nov.* 14, 1932.—A hollow circular cylinder is subject to extension, torsion and flexure. The general equations of equilibrium are solved for this case in terms of potentials involving Bessel functions. Application to a portion of a circular cylinder, bounded by two planes intersecting in the axis, and two coaxial cylindrical surfaces, is indicated. J. P. A.

451. Young's Modulus of Steel. J. Galibourg. *Comptes Rendus,* 195. *pp.* 1022–1025, *Nov.,* 1932.—Young's modulus for soft steel and nickel is shown to vary with the mechanical history of the specimen and the manner in which the stress is applied. A. S. C. L.

452. Isothermal and Adiabatic Moduli of Elasticity of Crystallised Quartz. R. de Mandrot. *Helv. Phys. Acta,* 5. *pp.* 362–368, *Nov.,* 1932. *In French.*—Fréedericksz and Michailow [see Abstract 4467 (1932)] have published measurements on the temperature variation of the S_{11} modulus of elasticity of quartz crystals. The results, while appearing to diverge from those obtained earlier by the present author, are shown to be due to their having obtained numerical values essentially adiabatic in contrast with the previous isothermal results. This is demonstrated by tables and curves, particularly in the region of the critical point $\alpha\beta$. H. M. B.

453. Mechanism of Plasticity. N. J. Seljakow. *Zeits. f. Krist.* 83. *pp.* 426–447, *Nov.,* 1932.—For rock-salt, plastic deformation is accompanied by the appearance of intermediate layers of monoclinic symmetry. The change of symmetry is brought about by simple gliding. The different values of the characteristic angle a for the monoclinic layers produces "starring" on the X-ray photographs. [See also Abstract 4048 (1932).] F. I. G. R.

454. Plasticity and Creep in Solids. H. Jeffreys. *Roy. Soc., Proc.* 138. *pp.* 283–297, *Nov.* 1, 1932.—The behaviour of a solid exhibiting both elastic and plastic phenomena may be represented by equations based on the following principle, *viz.*, the rate of increase of strain in an element consists of two parts, one linearly related to the rate of increase of stress, and the other to the stress itself. The equations are formulated and are shown to reduce in the limits to the equations for perfectly elastic solids, or to those for viscous fluids. The phenomena of creep or elastic after-effect may be due to the presence in a more perfectly elastic material of " pockets " of plastic substance. As illustrations of this theory the cases of a long circular cylinder having a core of different elastic and plastic properties, and of a series of coaxial cylinders of the same radius, fixed end to end, but of different properties, are considered in detail. The general circumstances of creep may be explained in this way. On applying the results to the transmission of distortional waves, it is shown that elastic after-effect can neither convert an impulse into a wave-train nor account sufficiently for the " blunting " of the wave-train in its passage. Forced vibrations in such an imperfectly elastic material will show a phase shift, if the frequency is neither too large nor too small. The connection of these results with the propagation of seismic waves is discussed.

J. P. A.

455. Particular Oscillations of a Flat Spring. J. Jaumann. *Zeits. f. Physik*, 79. 3–4. *pp.* 235–247, *Nov.* 14, 1932.—A partially-stretched flat spring is made to oscillate by a blow perpendicular to the flat surface. Starting with quick oscillations in the flat surface, a stationary state of torsional oscillations is produced. This is solved theoretically by a generalisation of Prandtl's theory of balance. A conical pendulum is used to illustrate qualitatively the dynamics of the oscillating conditions.

H. M. B.

456. Numerical Solution of Stability Problems. A. F. Cornock. *Phil. Mag.* 14. *pp.* 881–896, *Nov.*, 1932. *Supplement.*—Problems, such as those of elastic stability, where a characteristic value is sought, may be solved by a numerical method of successive approximation, based on Picard's method for the solution of differential equations. As examples, the lowest whirling speed of a shaft composed of several sections of different diameter and the frequency of vibration of a circular annulus of a flat plate are worked out in detail. J. P. A.

457. Surface Properties of Rubber. E. Vellinger. *Comptes Rendus*, 195. *pp.* 788–790, *Nov.* 7, 1932.—The influence of " fillers " on rubber is studied by measuring the interfacial tension, rubber solution in benzene/aqueous salt solution, by a tensiometer method. The rapid fall of interfacial tension which occurs above pH = 7 is attributed to free resin acids, which are soluble in acetone, and to other substances saponifiable at high pH values. It is concluded that the surface properties of rubber are mainly due to its resinous components. A. S. C. L.

458. Affinity of Rubber for " Fillers." E. Vellinger. *Comptes Rendus*, 195. *pp.* 1015–1016, *Nov.* 28, 1932.—" Fillers " which improve the mechanical properties of rubber are good absorbents; poor ones have little effect. This is due to the acetone-soluble resinous components of the rubber which are strongly adsorbed. The amount is calculated from interfacial tension measurements and follows a Freundlich isotherm.

A. S. C. L.

See also Abstracts 569, 720, 779, 780.

GRAVITATION.

459. Gravitational Anomaly at Mirandola. A. Belluigi. *Com. Naz. Italiano, Geod. and Geofis. Boll. No.* 9–10. *pp.* 152–155, *Sept.-Oct.*, 1932.—South of the River Po, between Guastalla and Bondeno, an important gravity anomaly extending over 1000 sq. km. has been revealed by torsion balance observations. The isogams, at equal intervals of 2·5 milligal, run positive from east to west in the region round Mirandola, and are deformed to the north of the line Mirandola–Bondeno from their general trend, which is parallel to the mean Apennine margin. The anomaly appears to be attributable to buried folds either of a marginal or of an external Apennine character. The author postpones a precise determination until further measurements have been made in this region. E. L. J.

460. Comparative Measurements of "g" with the Astatic Pendulum. G. Ising. *Bull. géodésique, No.* 28. *pp.* 556–576, *Oct.-Nov.-Dec.*, 1930.—The paper forms a continuation of an earlier one [see Abstract 3150 (1928)]. The theory of the method is explained and it is shown how variations of g may be determined by (1) a static, and (2) a dynamic method. In (1) the motion of the pendulum is obtained in terms of the known angular displacement of the heavy base, and in (2) by the time of oscillation of the pendulum. Full details of the apparatus are described and it is shown diagrammatically in section. The whole apparatus weighs 24 gm. and a series of observations occupies 50′. Errors arise from (1) pressure, (2) temperature, and (3) humidity changes in the atmosphere. A calibration curve allows for the effect of (1) on the base. The effect of (2) is avoided by enclosing the apparatus in an ice bath, and that in turn in a double-walled vessel lagged with felt, temperature being maintained constant to 0·01° C. The effect of (3) on the water film covering the quartz thread is eliminated by having the air around the pendulum constantly at 48·9 % relative humidity. The effects of elastic after-effect in the quartz and electrostatic disturbances are also considered. The results obtained by Urelius in 1929 successively at Stockholm, Copenhagen, Potsdam, Munich and Berne, out and back, are tabulated and for the two methods agree to $1 - 2 \times 10^{-6}$ for the values of g. R. S. R.

See also Abstract 527.

HYDRODYNAMICS AND AERODYNAMICS.

461. Circulation Near a Wing of Finite Span. L. Malavard. *Comptes Rendus*, 195. *pp.* 733–736, *Nov.* 2, 1932.—An experimental method previously described [see Abstract 68 (1933)], which may be substituted for the more usual numerical method for solving certain hydrodynamical equations, is here applied to the determination of the circulation near an aerofoil of finite width. A comparison with numerical calculation shows that the experimental results are in good agreement. J. P. A.

462. Theory of Wave Resistance. T. H. Havelock. *Roy. Soc., Proc.* 138. *pp.* 339–348, *Nov.* 1, 1932.—A purely mathematical paper, in which expressions are developed for the wave resistance of a continuous distribution of sources and sinks over a surface within a liquid, and for a similar distribution of normal doublets. The results are applicable to the determination of the wave resistance of any solid for which a suitable distribution can be found. The application of the results to the ship problem is briefly discussed. [See also Abstract 1464 (1928).] H. F. G.

463. Irrotational Motion of a Liquid Confined within Rigid Movable Walls. E. Cotton. *Comptes Rendus,* 195. *pp.* 987–990, *Nov.* 28, 1932.—The equations of Appell may with advantage be applied to the problem in place of those of Lagrange. H. F. G.

464. Experiments with Capillary Jets. E. Tyler and F. Watkin. *Phil. Mag.* 14. *pp.* 849–881, *Nov.,* 1932. *Supplement.*—Continuing earlier work [see Abstract 2421 (1925)], the properties of capillary jets of viscous liquids emerging into air or another viscous liquid are investigated. The curve relating jet length L with velocity of efflux V may be divided generally into three parts, two critical speeds being thus indicated. The upper critical speed is mainly controlled by the interfacial surface tension and the viscosity of the fluids, while the lower critical speed depends chiefly on drop formation. In explanation, (Lord) Rayleigh's formulæ for jet formation are modified to include the effect of viscosity. J. P. A.

465. Measurement of Critical Velocity of Flow past Objects of Small Section by Means of a Pitot Tube. E. Tyler. *Phil. Mag.* 14. *pp.* 990–1003, *Nov.,* 1932. *Supplement.*—The Pitot tube method has been used aurally for observation of the frequency of formation of Æolian waves behind obstacles such as aerofoils, cylindrical wires, and square section cords placed in a stream of air flowing at velocities up to about 300 cm. per sec. The minimum value of V_cD/ν at which detachment of eddies from the rear of the obstacle begins is about 62 for grazing incidence at an aerofoil section, and 46 and 38, respectively, for wires of circular and square cross section; for an angle of incidence of 12° at an aerofoil section the value falls to 46, and there is a still greater fall, to 25, at 25°. The decrease of resistance wth increase of inclination of cylindrical wires is caused by decrease of the rate of eddy formation; at normal incidence V_cD/ν is about 47. H. F. G.

466. Standard Pitot-Static Tube Calibration at Low Speeds. E. Ower and F. C. Johansen. *Engineer,* 154. *pp.* 500–502, *Nov.* 18, 1932.—Calibration of the standard type of Pitot-static tube anemometer for low air speeds by causing it to rotate around a central axis presents difficulties owing to the impossibility of eliminating swirl of the air through which the instrument moves. If, however, the tube moves through an annular wooden tunnel of about 2 ft. square section the swirl may be measured, by means of a hot-wire anemometer, to within 1 %, and the true air speed may be determined to within 0·1 %. Full details are given of the apparatus used. The calibration constant $K = P/(0\cdot 5\rho V^2)$, where V is the air speed, P the differential pressure and ρ the mass density, is approximately unity at speeds between 24 and 16 ft. per second, but falls to a minimum (0·991) at 10 ft. per second. The variations of K suggest that one type of flow predominates at speeds above 14 ft. per second, and that a different type appears at speeds below 2 ft. per second. In practice K may be taken as unity at all speeds above 5 ft. per second. H. F. G.

467. Scientific Instruments and Aeronautics. H. E. Wimperis. *Journ. Sci. Instruments,* 9. *pp.* 337–353, *Nov.,* 1932.—The author first describes the various difficulties attending the use of ordinary instruments for aerial navigation. Chief among these is the fact that the "apparent vertical," as shown by a quickly moving pendulum, has no simple relation to the true vertical. There is the further mechanical difficulty of the intense vibration to which every aeroplane instrument is subjected. The author goes on to describe the various forms of air-speed indicator in use. An important function of this instrument is to show the pilot whether his speed is falling close to that at which stalling takes place. The altimeter is an adaptation of the aneroid barometer in which allowance is made for the fall in air temperature with increase of height (6·5° C. per km.). The "turn indicator" depends on the measurement of the precessional torque of a gyroscope suitably mounted. This torque can be combined with the "banking" couple on a pendulum so as to cause the latter to indicate the true vertical. A gyroscope, mounted with its axis vertical, may be used to operate pneumatic or electric relays so as to move aeroplane controls and keep the craft level to a surprising degree of steadiness. The compass is subject to several errors, the most important of which is the "northerly turning error" which causes the compass to give an untrue indication when the aeroplane is changing course. The use of the gyroscopic compass, the accelerometer and the measurement of ground speed are all considered in detail. J. W. T. W.

468. Hydraulic Analogy Corresponding to the Motion of a Compressible Fluid. D. Riabouchinsky. *Comptes Rendus*, 195. *pp.* 998–999, *Nov.* 28, 1932.—An analogy in the mathematical analysis of wave motion in air and in a liquid, *e.g.*, water, is briefly discussed.

J. S. G. T.

See also Abstract 470.

KINETIC THEORY OF MATTER.

469. Optical Investigation of the Accommodation Coefficient of Molecular Translation and the Distribution Function of the Latter in an Attenuated Gas. L. S. Ornstein and W. R. v. Wyk. *Zeits. f. Physik*, 78. 11–12. *pp.* 734–743, *Oct.* 28, 1932.—The intensity distribution in the line 5016 Å. emitted from excited helium gas confined between two cylinders at temperatures 650° C. and 370° C. respectively was measured with a Fabry-Perot étalon observing perpendicular to the cylinder walls. The Doppler widening of the line on the red side corresponds to emitting atoms receding from the higher temperature wall (and from the observer), while the widening on the violet side corresponds to emitting atoms leaving the lower temperature wall. From the shape of the intensity distribution on either side the distribution function for the two groups of atoms, and hence the accommodation coefficient, could be determined. Atoms leaving the cold wall had an exact Maxwellian distribution corresponding to a temperature nearly equal to that of the wall. Atoms leaving the hot wall exhibited only an approximate Maxwellian distribution, the corresponding temperature being 480° C. The accommodation coefficient, helium on glass, equalled 0·32. A considerable part of the paper describes the determination of the true intensity distribution from that observed, allowing for the inevitable broadening of the spectral line by the Fabry-Perot étalon. W. S. S.

See also Abstract 643.

MATHEMATICAL METHODS. THEORY OF MEASUREMENTS. UNITS AND DIMENSIONS.

470. Applications of Prolate Spheroidal Harmonics. D. M. Wrinch, Hestha Ayrton and S. T. Fellow. *Phil. Mag.* 14. *pp.* 829–848, *Nov.*, 1932.—The problems considered with the aid of prolate spheroidal harmonics are electrical and hydrodynamical ones in which the distribution in a charged spheroid in various circumstances, or the flow past a spheroidal obstacle, as the case may be, is the subject of enquiry. J. H. A.

471. Determination of the Constants of a Polar Planimeter. P. Werkmeister. *Zeits. f. Instrumentenk*, 52. *pp.* 473–479, *Nov.*, 1932.—The accuracy of the constants found for a polar planimeter are considered dealing with the pole (1) inside, and (2) outside the surface. The theory of each is set out and the accuracy attainable for a given surface and another surface of known area. In case (2), two methods are considered in which the two constants are found separately or jointly. From a comparison of the methods it is concluded that one should work with the pole inside for large surfaces where subdivision into more than six parts is necessary, but outside for smaller surfaces where subdivision is required into not more than two parts. R. S. R.

See also Abstracts 435, 456, 788.

MECHANICS, CLASSICAL.

472. Calculation of Wind Stresses in High Building Frames. F. Takabeya. *Hokkaido Imp. Univ., Eng. Mem.* 3. *pp.* 33–63, *Oct.*, 1932. *In English.*—The bending moments at the joints of a skyscraper frame are evaluated by a quick method based on the observation that if the wind acts like a system of equal forces W at the joints on one side of the frame the joint moments are given very nearly by the linear expression $\{a + b(n - 1)\}(Wh/2)$, where n is the number of the storey numbered from the roof, and a and b are constants depending on the characteristics of the columns and girders, number of bays, etc., and h is the height of each storey. R. F. A.

473. Forces Varying Inversely as any Function of the Distance. M. Kiveliovitch. *Accad. Lincei, Atti*, 16. *pp.* 227–230, *Sept.*, 1932. *In French.*—Works out, by canonical transformations, a set of typical equations for binary shocks under the above forces. A. D.

474. Dynamical Applications of Stieltjès' Integral. G. Bouligand. *Accad. Sci. Torino, Atti*, 67. 3–7. *pp.* 131–139, 1931–1932. *In French.*—Develops partial differential equations for the movement of a suspended cord along the length of which the masses are distributed in any manner whatsoever. A. D.

475. Motion of Rigid Systems in a Space of n Dimensions. C. Agostinelli. *Accad. Sci. Torino, Atti*, 67. 8–10. *pp.* 219–236, *and* 11–13. *pp.* 246–266, 1931–1932.—The formulæ and fundamental properties of the kinematics of rigid systems in ordinary space are generalised to the case of motion in a Euclidean space of n dimensions. Different results are obtained according as the space is of even or odd dimensions. A. J. McC.

476. Motion of a Deformable Body which Remains Similar to Itself. Part II. Instantaneous Centre of Velocity. M. Pascal. *Accad. Lincei, Atti*, 16. *pp.* 320–324, *Oct.*, 1932.—In a previous paper [see Abstract 4049 (1932)] it was shown that in every straight line of a deformable body which moves remaining similar to itself there is at every instant a point whose velocity is perpendicular to that line, and that besides there exists an axis of motion defined as the locus of all the points

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of the body whose velocity is parallel to that axis. Thus the straight line that, at the instant considered, is axis of motion must contain a point whose velocity, being at the same time perpendicular and parallel to the axis, can be only zero. In the present paper such a point is determined by solving the problem of finding the locus of all the points of the deformable body the magnitude of whose velocity is at a certain instant equal to a previously fixed constant value. J. J. S.

477. Effect of Air Resistance on the Deviation of Falling Weights. B. Giannelli. *N. Cimento,* 9. *pp.* 259–263, *Aug.-Sept.-Oct.,* 1932.—The motion of a weight falling in air from a height is calculated by the method of perturbations, taking the unperturbed motion to be that of a weight falling *in vacuo,* and with the rotation of the earth taken into account. The results show that the experiments of Hall in 1903 are in better agreement with theory than had previously been believed. J. H. A.

478. Rotary Oscillation of a Long Circular Cylinder in a Viscous Fluid. H. F. Winny. *Phil. Mag.* 14. *pp.* 1026–1032, *Nov.,* 1932. *Supplement.*—Theory is given and a solution obtained for the two-dimensional case of a rotating cylinder oscillating in simple harmonic motion in an incompressible fluid. The motion consists of pressure waves of decreasing amplitude propagated outward from the cylinder. The method of obtaining the amplitude of the waves experimentally is described. Theoretical and experimental curves for oil and water with the cylinder oscillating at different frequencies are given, and the results show agreement within experimental error. H. M. B.

479. Particular Cases in the Problem of Three Bodies. M. Kivelliovitch. *Comptes Rendus,* 195. *pp.* 763–765, *Nov.* 7, 1932.—It is shown how to determine the position of a collision-point between two of the bodies. G. C. McV.

480. Apparatus to Demonstrate the Nature of Centrifugal Force. G. Mayr. *N. Cimento,* 9. [6 *pp.*], *June,* 1932. *Rivista.*—In the case of a body rotating round an axis the tendency to fly away from the axis is often erroneously said to be caused by the centrifugal force. Two simple experiments are described to show that (1) the tendency to fly away from the axis is due to the body's inertia, and (2) the centrifugal force acts upon the constraint and not upon the body. A. J. McC.

See also Abstracts 482, 493, 501.

MECHANICS, QUANTUM.

481. Electromagnetic Field of a Light Wave. L. de Broglie. *Comptes Rendus,* 195. *pp.* 862–864, *Nov.* 14, 1932.—In continuation of previous work [see Abstract 4802 (1932)] the author suggests that the relation of the photonic ψ waves and the fields of the associated electromagnetic wave is the same as that existing in wave mechanics between the electronic ψ waves and the matrix elements of Heisenberg and Schrödinger. The postulate necessary for the explanation of the occurrence of interference fringes is discussed. J. S. G. T.

482. Function in Quantum Mechanics Corresponding to a Given Function in Classical Mechanics. N. H. McCoy. *Nat. Acad. Sci., Proc.* 18. *pp.* 674–676, *Nov.,* 1932.—An extension of Weyl's rule for carrying a function over from classical to quantum mechanics If $f(p, q)$ be a polynomial in the canonical variables p, q of classical mechanics, an explicit expression for F(P, Q), the corresponding function of the Hermitian operators P, Q in quantum mechanics, is obtained. N. M. B.

483. Approximation of Geometric Optics as Applied to a Dirac Electron Moving in a Magnetic Field. O. Laporte. *Phys. Rev.* 42. *pp.* 340–347, *Nov.* 1, 1932.—The problem of a Dirac electron in a homogeneous magnetic field is integrated according to the recently published approximative method of Pauli [see Abstract 4121 (1932)]. Homogeneous linear equations furnish, except for a multiplicative function, the eigenfunctions in zero approximation. An important condition of compatibility of the zero and first approximation determines these multiplicative functions. For the connection of the solution in the classically occupied regions with those that are classically not reached the Kramers connection formulæ are used. The eigenvalue determination gives the result that the phase-integral is to be quantised not with half quantum numbers as is the case unrelativistically, but with whole quantum numbers, each level possessing a twofold degeneracy. AUTHOR.

484. Sauter's Method for the Solution of the Dirac Equation without Particularising the Operators. K. Bechert. *Zeits. f. Physik*, 79. 1–2. *pp.* 26–34, *Nov.* 7. 1932.—Sauter's method [see Abstracts 49 and 361 (1931)] is simplified by a suitable arrangement of the 16 spin operators. The method described facilitates calculations with the Dirac equation. W. S. S.

485. Wentzel-Brillouin Eigenvalue Calculations. E. Fues. *Zeits. f. Physik*, 78. 9–10. *pp.* 580–585, *Oct.* 18, 1932.—Wentzel and Brillouin have each shown that many problems in wave mechanics can be solved by the expansion of the wave function ψ in powers of h. In the present paper the method is further developed, taking into account the boundary conditions. J. E.

486. Experimental Demonstration of the Effects of Coupling of Harmonic Motions, as Illustrating Phenomena in Quantum Mechanics. A. C. Burton. *Phil. Mag.* 14. *pp.* 777–788, *Nov.*, 1932.—Coupled electrical circuits for demonstrating the characteristics of quantum resonance are described and the theory of the circuits developed.

J. S. G. T.

See also Abstracts 673, 757, 758, 759.

RELATIVITY AND ETHER.

487. Einsteinian Correction of Time in a Planetary Motion. M. Cimino. *Accad. Lincei, Atti*, 16. *pp.* 223–227, *Sept.*, 1932.—In a previous paper [see Abstract 4821 (1932)] the author worked out a law of areas for Einsteinian motion in a field considered as Euclidean. In the present one he extends it so as to find a law for cosmic time and the periods of revolution. This enables corrections to be applied to the data of observation; which corrections are extremely minute. A. D.

488. Experimental Establishment of the Relativity of Time. R. J. Kennedy and E. M. Thorndike. *Phys. Rev.* 42. *pp.* 400–418, *Nov.* 1, 1932.—None of the fundamental experiments on which the restricted principle of relativity is based requires for its explanation that the classical concept of absolute time be modified; the present experiment was devised to test directly whether time satisfies the requirements of relativity. It depends on the fact that if a pencil of homogeneous light is split into two components which are made to interfere after traversing paths of different length, their relative phases will depend on the translational velocity of the optical system unless the Lorentz–Einstein transformation equations are valid. Hence, such a system at a point on the earth should give rise to an interference pattern which varies periodically as the velocity of the point changes in consequence of the rotation and revolution of the earth. The effect to be expected for a small velocity is so very small that it has been necessary to devise a special source of light, an interferometer of great stability and a refinement of the technique of measuring displacements in the interference pattern. With the apparatus finally employed, we have shown that there is no effect corresponding to absolute time unless the velocity of the solar system in space is no more than about half that of the earth in its orbit. Using this null result and that of the Michelson–Morley experiment we derive the Lorentz–Einstein transformations, which are tantamount to the relativity principle.

AUTHORS.

489. Linearity of the Lorentz Transformations. M. H. A. Newman. *Cambridge Phil. Soc., Proc.* 28. *pp.* 460–462, *Oct.* 31, 1932.—In his derivation of the Lorentz transformations Einstein assumed the required transformation to be linear, on the ground that the space-time of Galilean frames is homogeneous. The author shows that the linearity is a direct consequence of the wave-equation of light,

$$\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2\phi}{\partial t^2}=0,$$

and that it is not necessary to advance the argument of homogeneity in space-time to account for it.

A. D.

490. Existence of a Metric and the Inverse Variational Problem. D. D. Kosambi. *Acad. Sci. U.P., India, Bull.* 2. *pp.* 17–28, *Aug.*, 1932.—A mathematical paper on the conditions for the existence of a Riemannian metric in a manifold with affine connection whose paths are given.

G. C. McV.

491. Dirac's Equations and the Unitary Theory of Einstein and Mayer. W. Pauli and J. Solomon. *J. de Physique et le Radium*, 3. *pp.* 452–463, *Oct.*, 1932.—The form taken by Dirac's equations in the Einstein-Mayer unitary theory is examined. A study of the introduction of spinors in five-dimensional space and their parallel displacement, and simple considerations of invariance allow the formulation of Dirac's equation and the deduction of an expression for the current. Finally, the authors establish the expression for the energy-momentum tensor, which demands the introduction of a quadri-vector potential in Dirac's equation. In an addendum the authors refer to the recent work of Schouten and Dantzig [see Abstracts 102, 103, 104 (1933)], remarking that the latter employ a different mathematical system in which two dimensions out of the five are temporal instead of one, and the energy-momentum tensor is not explicitly indicated.

E. E. F. d'A.

492. Esclangon Effect is Ether Drift Observed by Miller at Mount Wilson. E. Carvallo. *Comptes Rendus*, 195. *pp.* 769–771, *Nov.* 7, 1932.—The author contends that Miller's positive results relating to ether drift derived from experiments carried out at Mount Wilson are attributable to the so-called Esclangon effect, *viz.*, that a reflected light ray is deviated owing to the velocity of the reflecting mirror. This effect is nil when this velocity is parallel or normal to the mirror, it is a maximum when the velocity is at 45° to the mirror. [See *Journal des Observateurs*, 1929, 11, IV, p. 49.] J. S. G. T.

493. Space-Structure and Motion. G. Strömberg. *Science*, 76. *pp.* 477–481, *Nov.* 25, *and pp.* 504–508, *Dec.* 2, 1932.—A general discussion of the meaning of motion is undertaken. A distinction is made between the kinematic description of motion, in which forces are distinct from the space-structure, and the dynamical, in which forces play no part, but alterations in space-structure control the motions of bodies. G. C. McV.

See also Abstract 754.

SOLUTION.

See Abstracts 656, 663, 751.

SURFACE TENSION AND COHESION.

494. Quantitative Limiting Equation of the Surface Tension of Strong Binary Electrolytes. T. Sakai. *Phys. Math. Soc., Japan, Proc.* 14. *pp.* 524–526, *Oct.*, 1932. *In German.*—The author shows that the value of an integral in the work published recently on the subject by S. Oka [see Abstract 4004 (1932)], which was not originally deduced, is capable of exact calculation. In the previous paper $\Delta\sigma$ = the relative variation of the surface tension of an electrolyte with n = the number of ions per c.c., T = the absolute temperature, k = the Boltzmann constant, D = the dielectric constant of the solution, and e = the elementary charge on the ions; and a further value (κ^2) is substituted for the expression $\kappa^2 = (8\pi n e^2)/(\mathrm{D}kt)$. If D is very great then the author gives the expression $\Delta\sigma = (2\pi e^4 n^2)/(\mathrm{D}^2 k\mathrm{T}\kappa^2) \times (1 \cdot 06/\mathrm{D})$, in contrast to that of S. Oka, which was $\Delta\sigma = (2\pi e^4 n^2)/(\mathrm{D}^2 k\mathrm{T}\kappa^2)$. Thus the author's theoretical value is approximately 1/D times less than that of Oka, although the experimental data are in better agreement with the latter's expression. In consequence the author urges further development of the theory.

S. G. B.

495. Quantitative Limiting Equation of the Surface Tension of Strong Binary Electrolytes. S. Oka. *Phys. Math. Soc., Japan, Proc.* 14. *pp.* 527–528, *Oct.*, 1932. *In English.*—Whilst in the earlier paper [see Abstract 4004 (1932)] the data were calculated by means of the Laplace-Rayleigh method, in order to ascertain the surface tension of the liquids under discussion, a further and simpler method is now proposed. The method is essentially the calculation of the opposite potential energy (U) per unit surface, which stands in relationship to the mechanical work per unit area (W), which must be performed externally if both conditions of the fluid hypothesised be taken from a position of proximity to an infinitely long distance apart by means of an infinitely long isothermal, as follows, namely, U = − W. By the new method of deduction the author arrives simply at the final formula which coincides with that formerly obtained by the other method. S. G. B.

496. Structure of Surface Films. Part XVI. Surface Potential Measurements of Fatty Acids on Dilute Hydrochloric Acid. N. K. Adam and J. B. Harding. *Roy. Soc., Proc.* 138. *pp.* 411–430, *Nov.* 1, 1932.—By a slightly modified method [see Abstract 1199 (1926)] surface pressure (F), and potential (ΔV)/area curves were simultaneously determined for myristic, palmitic, stearic, and behenic acids. The ΔV/A curve for myristic acid showed no discontinuity, and only the metastable curve was obtained, affording no evidence that the condensed and liquid expanded types of films are distinct surface phases, or for existence of the homalic and pre-homalic phases [see Abstract 2072 (1931)]. With increasing length of chain ΔV increases slightly; it also increases almost proportionally to the number of molecules per given area when the liquid expanded film is compressed, but decidedly lessens proportionally to that number on compressing the condensed film: the vertical component of change in dipole moment per molecule rises slightly in the first case, to fall slightly in the second, indicating little change in the orientation of the carboxyl groups. Measurements of these moments are in general agreement with existing data. C. A. S.

497. Surface Potentials of Unimolecular Films. Part IV. Effect of Underlying Solution and Transition Phenomena in the Film. J. H. Schulman and A. H. Hughes. *Roy. Soc., Proc.* 138. *pp.* 430–450, *Nov.* 1, 1932.—By means of an improved method [see Abstract 2072 (1931)] ΔV/area (A) curves have been determined for films of myristic acid and dodecyl alcohol on $0{\cdot}0001 - 4N$ HCl, and (for the alcohol) on $0{\cdot}01N$ NaOH; $\Delta V/p_H$ curves for myristic acid, octadecylmethyl ether, and tetradecyl alcohol; and ΔV determined for tetradecyl alcohol on solutions of various concentrations of several salts, the latter showing usually an increase in ΔV, but never a decrease. The ΔV/A curves are expressible for each state by the relation $\Delta V = an + b$, where n denotes molecules/cm.^{2} (this line extrapolated to $n = 0$ gives a negative value of ΔV for the expanded, a positive value for the condensed state). Combining this with the relation $\Delta V = 4\pi n\mu$ (μ = vertical component of the polypole system due to one molecule of the film) it is deduced that for any one state μ consists of a portion, $\bar{\mu}$, due to the film forming material, and another to the underlying solution, *e.g.*, in the case of *aq*.HCl to the formation of an ionisation complex on the polar head group. Force/A and ΔV/A curves for hexadecyl and eicosyl alcohols are then compared for the condensed states showing general agreement regarding the limits of the states, but that their classification as " solid " and " liquid " is incorrect. They are accordingly designated α and β, α possibly representing increased approximation of the head groups due to squeezing out of molecules of the solvent, and β the subsequent reorientation of the head groups. C. A. S.

498. Influence of Picric Acid on the Electrocapillary Curve of Mercury. H. Breindl and K. Söllner. *Zeits. f. Elektrochem.* 38. *pp.* 843–846, *Nov.*, 1932.—The effect of picric acid on the electrocapillary curve of mercury was determined. The measurements were made with carefully cleaned and purified mercury, and in an apparatus which avoided the tendency of the mercury to stick to the glass of the capillary tube. It was found that the picrate ion migrated in the electrical field so that the equilibrium concentration at the boundary mercury-solution was not known with any degree of certainty. The electrocapillary curves of mercury in the presence of picric acid are given with reservation. The method of null-current determination of the electrocapillary curve is not applicable to this problem. F. J. B.

499. Direct Measurement of the Surface Tension of Superficial Solutions Produced by Soluble Substances. A. Marcelin and D. G. Dervichian. *Comptes Rendus*, 195. *pp*. 866–869, *Nov*. 14, 1932.—Talc is dusted on the surface of the solution and a jet of air is directed normally on to the surface, and the superficial tension determined from measurements of the circular area from which the talc is driven away by the jet. J. S. G. T.

See also Abstract 464.

TIME (STANDARDS, MEASUREMENTS, APPARATUS).

500. Quartz Clock for Time and Frequency Measurement of Very High Accuracy. A. Scheibe and U. Adelsberger. *Phys. Zeits.* 33. *pp*. 835–841, *Nov*. 1, 1932.—A quartz clock is described. It consists of an oscillator of frequency 60,000 $\sim$ controlled in frequency by a quartz crystal vibrating piezoelectrically. The crystal is enclosed in a thermostatically-controlled space. The frequency is stepped down in three stages; in each stage the frequency is a sub-multiple of that in the preceding stage. The final frequency of 333 $\sim$ drives a synchronous motor which is made to discharge a condenser every 4·5 or 9 sec. This condenser discharge operates an automatic recorder. Comparisons of the time-keeping of two such clocks with astronomical time are described. Over a period of several days the two clocks kept the same time to within a mean value of ± 0·0003 sec. per day, the absolute constancy of one of the clocks being ± 0·001 sec. per day. Over a period of six months this clock showed a mean variation of ± 0·002 sec. per day. G. G. S.

501. Isochronism of Pendulums. J. Haag. *Comptes Rendus*, 195. *pp*. 756–758, *Nov*. 7, 1932.—Placed symmetrically on either side of the equilibrium position of a pendulum are two springs with each of which the pendulum makes contact once in each oscillation. Experience shows that when the amplitude is thus restrained, the isochronism of the pendulum is improved. An outline of the theory is given, and examples are briefly worked out. J. P. A.

VACUA, HIGH.

502. High-Speed High-Vacuum Diffusion Pumps. I. Estermann and H. T. Byck. *Rev. Sci. Instruments*, 3. *pp*. 482–487, *Sept*., 1932. *Paper read before the Am. Phys. Soc.*—The ordinary glass diffusion pump has normally a low speed, and difficulty is experienced in increasing the speed by increase of size; metal pumps of high speed can be made, but require adequate workshops, and are expensive to buy. The present paper describes a high-speed pump which can easily be made. The body is of glass, and the diffusion aperture, which is of the annular type, is made by a metal cowl of the type commonly used in metal pumps. Working dimensions are given, and it is shown that the maximum speed is obtained with a diffusion aperture about 5 mm. wide. Pumps of this type can be modified for use with organic liquids such as butyl phthalate. Speeds up to 13 litres of air per sec. can be obtained, using backing pressures of the order of 1 mm. G. E. B.

See also Abstract 672.

VISCOSITY, FRICTION AND LUBRICATION.

503. Viscosity of a Non-Wetting Fluid. M. Reiner and S. Erk. *Zeits. f. Physik*, 79. 1–2. *pp*. 139–142, 1932.—M. Reiner challenges the conclusion of S. Erk [see Abstract 1788 (1928)] that slip does not take place between mercury and a capillary tube which it does not wet. He supposes that there is a film of air of normal viscosity between the mercury and the wall of the tube, and concludes that the viscosity ordinarily measured by the capillary tube method is greater than the true viscosity by an amount too small to be detected experimentally except with tubes of the order of 5 to 10 μ. S. Erk accepts the presence of an air film, but points out that if such a film had the normal viscosity of air it would be quickly swept away. Treating the film as an adsorbed film, which is well known to be difficult to dislodge, the conclusion is reached that the true viscosity is not greater but less than the measured viscosity by an amount much smaller than that arrived at by Reiner. It may be taken that the air film virtually reduces the radius of the capillary by the thickness of the film. P. H. B.

504. Adsorption. W. Hardy and Millicent Nottage. *Roy. Soc., Proc*. 138, *pp*. 259–283, *Nov*. 1, 1932.—The variation with temperature of static friction of mixed lubricants on steel surfaces is measured and discussed [see Abstract 1790 (1928)]. The lubricant is a solution of active components in a diluent. This, when freed from selectively adsorbed constituents, is called an adsorption individual. It has no temperature coefficient of friction from 10° to 106° C. The variation of static friction from the value for pure solvent to that for pure component takes place over a narrow temperature range. The actual curve followed depends upon the thermal history of the lubricant while in contact with the steel surfaces. The curves are interpreted as meaning that an active component can be adsorbed only if present in the correct degree of dispersion. The region in which the friction varies with temperature is the region over which the necessary degree of dispersion is attained. A component may be available or not for adsorption according to its state, but, even if available, it may be unable to displace the molecules already in possession of the " clean " surface, in which case they are described as not accessible. Differences in the state of the lubricant film are described; and the meaning of the values of static friction is discussed. A. S. C. L.

See also Abstracts 423, 464, 478, 643, 650, 741.

ASTRONOMY AND ASTROPHYSICS.

ASTRONOMICAL APPARATUS AND OBSERVATORY EQUIPMENT.

505. Photographic Spectrophotometry. J. Wempe. *Zeits. f. Astrophysik*, 5. *pp.* 154–204, *Oct.* 28, 1932.—A study of intensity distribution in stellar continuous spectra, necessary for the determination of stellar temperatures, is the aim of the " temperature programme " which was undertaken some time ago in Göttingen. The preliminary work for determining the photometric scale (grating constant) and the effects of various instrumental and atmospheric sources of error is now finished, and the results are here described in detail, including the solution of many unexpected difficulties which were encountered by the way. The eventual attainment of the desired goal seems now to be assured. M. A. E.

506. Thermionic Amplifier for the Photometry of Stars. A. E. Whitford. *Astrophys. J.* 76. *pp.* 213–223, *Nov.*, 1932.—A thermionic amplifier employing the FP-54 Pliotron valve for amplification of photoelectric currents in stellar photometry is described. A marked improvement in stability has been attained by evacuating the space around the photoelectric cell and amplifier tube. The least current which can be detected is approximately $1\cdot 1 \times 10^{-16}$ ampere, which corresponds to the light effect from a star of magnitude 14·3 at the focus of the 15-in. refractor, using a potassium-hydride cell by Jacob Kunz. As the amplification factor is about 2,200,000, such currents can be measured with a galvanometer. It is possible to observe stars of magnitude 9·0 with a probable error of not over $\pm 0\cdot 03^{\mathrm{m}\cdot}$ for one deflection, and brighter stars with greater precision. Preliminary results for W Ursæ Majoris and ϵ Lyræ, obtained by Stebbins and Huffer, with the 15-in. telescope of the Washburn Observatory, are included to show the possibilities of the instrument. AUTHORS.

See also Abstract 508.

COSMOGONY.

See Abstracts 513, 517.

DYNAMICAL PROBLEMS (ASTRONOMICAL).

See Abstracts 487, 524.

LATITUDE AND LONGITUDE.

See Abstract 524.

NEBULÆ.

507. Possible Globular Clusters in Andromeda Nebula (M31). J. H. Reynolds. *Observatory*, 55. *pp.* 301–304, *Nov.*, 1932.—M33 has wreaths and groups of discrete star discs in both the inner and outer regions; in M31, nebulosity masks the interior, and the nebulous spots (of which 140 have been listed) are found scattered more at random than in our galaxy, although somewhat concentrated towards the nucleus; no actual star discs are visible, and any stars contained in them must be fainter than the 20th magnitude. Their colour indices are, however, of F or G type agreeable to the galactic globulars; there seem to be two distinct groups having respectively absolute magnitudes − 5 and − 6·2. But M31 must be in a different state of development (either reached or inherent) from M33 or our galaxy. There is need of an intensive photographic study of the spiral nebulæ of large angular diameter nearest to us in space, for M31 and M81 stand out amongst these as exceptional instances of early type spirals. It is suggested that the amorphous M31 type is much more massive and of slower growth. A. S. D. M.

See also Abstracts 510, 517.

PLANETS.

508. Micrometric Measurements of Eros, 1930–1931. W. H. van den Bos and W. S. Finsen. *Union Obs. S. Africa, Circ. No.* 88. *pp.* 313–318, *Aug.* 22, 1932.—On account of poor star fields near Eros, the usual micrometer of Union Observatory 26½-in. refractor had insufficient range; the fitting of additional threads for convenient measurement up to 7½ minutes of arc in each rectangular coordinate is described, with the additional sources of error introduced, method of observing and adopted reduction. The table of results follows, with notes and references. T. L. M.

See also Abstract 524.

STARS.

509. Representation of Mean Parallaxes by Empirical Formulæ. F. K. Edmondson. *Astron. J. No.* 981. *pp.* 95–96, *Nov.* 7, 1932.—An attempt to find approximate empirical relationship between mean parallax and apparent magnitude. A table gives the writer's mean parallaxes for the first five apparent magnitudes, the graduated values from the fit of Kapteyn's curve, and also the values of Kapteyn and of Schouten; this shows that the curve does not give a true representation of the data. The best empirical formula (out of twenty tried by the author) is of the type $\log \bar{\pi} = A + B/m$, but it does not make $\bar{\pi}$ zero when m is infinite. The constants are $A = 8{\cdot}035$, $B = 1{\cdot}040$; a table of graduated values suggests that two empirical values should be used, one for stars brighter, the other for stars fainter than the 5th magnitude; and it is therefore inferred that the laws of density and luminosity are not the same for these two series. [See also Abstract 4183 (1932).] A. S. D. M.

510. Stellar Radial Velocities. R. O. Redman. *Nature*, 130. *pp.* 836–837, *Dec.* 2, 1932.—A review of Moore's general catalogue of radial velocities of 6739 stars, 133 gaseous nebulæ, 18 globular clusters and 90 extra-galactic nebulæ issued by the Lick Observatory. The writer shows that a reflector of not less than 36-in. aperture and Cassegrain form is best for such work, using prisms in number, three for bright stars to one for very faint. He refers to Slipher's work on the extra-galactic nebulæ where the objects are faint, without concentration and with absorption spectra, and also to the more recent work at Mt. Wilson by means of a special short-focus camera lens working at $f0{\cdot}6$. In normal stellar work all stars down to magnitude 5·51 have been completely observed in both northern and southern hemispheres. Otherwise for groups such as the Boss stars, the brighter dwarfs, the O to B5 stars, down to magnitude 7·5, etc., work has been done only in the northern hemisphere. Until this gap is filled in the south, observational studies such as galactic rotation must necessarily be incomplete. A. S. D. M.

511. Intensity Distribution in the Spectra of the Brighter Pleiades. H. Strassl. *Zeits. f. Astrophysik,* 5. *pp.* 205–259, *Oct.* 28, *and p.* 376, *Dec.* 9, 1932.—The stars of the Pleiades cluster down to the 14th magnitude have been thoroughly investigated as regards brightness and colour and classification of spectra, but more work on their spectrophotometry is necessary in order to determine whether stars in galactic clusters differ physically from isolated single stars of the same type. With this end in view, the intensity distribution in the continuous spectrum between 3500 and 5100 Å. of twenty Pleiades stars has been compared with that of eight isolated stars (in Perseus, Taurus, Auriga and Gemini); and it is found that they do not differ, and no effect can be traced of the nebulosity in which the cluster stars are involved. M. A. E.

512. Intensity of C_2 and CN Bands in Spectra of R and N Type Stars. K. Wurm. *Zeits. f. Astrophysik,* 5. *pp.* 260–273, *Oct.*, 1932.—The intensity distribution in single bands and flutings within the complex molecular bands of C_2 and CN in these types of stars, and in their subtypes, is examined; and it is shown that it gives a reliable and accurate determination of the temperatures of their reversing layers. These flutings have sharp edges, and the first two or three of each band can easily be compared in the spectrograms used. They indicate a temperature of about 1500° for the N_0 subdivision of N stars. The strength of the absorption varies with the subtypes, both C_2 and CN increasing rapidly from R_0 to R_8, but after this CN decreases, while C_2 increases from N_0 onwards. Nevertheless, the temperature in subclasses of N stars varies very little, probably only by a few hundred degrees. M. A. E.

513. Space Distribution of Stars of Different Spectral Classes. F. Becker. *Zeits. f. Astrophysik,* 5. *pp.* 274–287, *Oct.*, 1932.—Stars of different spectral classes have in a previous work been examined for their respective apparent brightness and galactic latitude. They are now examined (B8 to K5) for their respective space distribution, and it appears that even in the galactic plane stellar density decreases so rapidly at a certain distance that a possible effect of general absorption cannot wholly account for it. The conclusion is reached that the limits of our stellar universe are narrower than has been supposed, attaining only a few thousand parsecs in diameter at the galactic equator. [See also Abstract 3655 (1932).] M. A. E.

514. Criterion for Existence of General Interstellar Absorption. A. Brill. *Zeits. f. Astrophysik,* 5. *pp.* 288–293, *Oct.*, 1932.—Evidence has been produced by several observers for interstellar absorption in and near the galactic plane, and if it exists Shapley's estimated distances of globular clusters are too great. The question could be definitely solved if it could be shown that there is a systematic difference between the distances derived from trigonometrical measurement (where absorption has no effect) and those derived from spectrum, colour or period of variation. But at present the observational material is not adequate for this test. M. A. E.

515. Absorption of Light in the Galactic System. P. van de Kamp. *Astron. J. No.* 932. *pp.* 97–106, *Nov.* 30, 1932.—A computation of the thickness of the absorbing layer in the galactic system is given based on statistical studies of the space distribution of various types of objects.

The deviations from uniform apparent distribution of extragalactic nebulæ in the Harvard survey and in the Mount Wilson selected area survey lead, respectively, to optical thickness 0·8 and 1·4 pg. mag. for this layer. The distribution of globular clusters leads to a thickness of 0·6 pg. mag., central location for the sun being assumed. The conclusion, however, is in favour of the value 0·8 ± 0·2 pg. mag. for the thickness and a location of the sun nearer the northern effect limit of the layer. The deduced major diameter of the galaxy is then 14 ± 3 *kpc*. Measures of the ratio of the thickness of the dark equatorial bands found in certain spiral nebulæ, to their diameters, gives some support to the above values for the thickness of the layer and the diameter of our own galaxy.

G. C. McV.

516. Spectral Types of Faint Stars in Kapteyn's Selected Areas 1–115. M. L. Humason. *Mt. Wilson Observat. Contrib. No.* 458. *Astrophys. J.* 76. *pp.* 224–274, *Nov.*, 1932.—Spectral types have been determined for 4066 stars in the first 115 areas of Kapteyn's systematic "Plan of Selected Areas." The results are given in tables and in the form of frequency diagrams: (*a*) for each spectral class in all galactic latitudes together, (*b*) for each spectral class in three zones of galactic latitude, and (*c*) for each spectral division in different intervals of photographic magnitude and galactic latitude. The maximum frequency among stars of photographic magnitudes 11·0–13·3 ± was found in division G (F4–G4). The numbers of G-stars increase with increasing photographic magnitude and galactic latitude. In low galactic latitudes (0°–12°) high frequencies are observed in division A among stars brighter than 9·5. Class B-stars are concentrated in the region of Selected Area 98, which includes 44 % of all the B-stars observed. In high galactic latitudes, 68 % of the stars of photographic magnitude 12·5 are in division G. The large majority of these stars are probably dwarfs at distances of 500 parsecs or less.

AUTHOR.

517. Local Star System. F. Becker. *Ergeb. d. Exakt. Naturwiss.* 11. *pp.* 1–30, 1932.—An attempt to define the local cluster in modern work. Early ideas (Herschel, Gould, Newcomb) are brought into relation with modern ideas. The importance of Charlier's research on B-stars is emphasised, with Shapley's application of the same idea in connection with his greater system of the globular clusters. The problem of interstellar absorption is discussed at some length, Seares' researches in particular; the author, emphasising the hypothetical factor, regards the method as at present a blind alley. As regards method, the author lays more stress on the star-density work of Pannekoek, and on the study of distribution by spectral class. Discussing recent work on systematic motions, the difficulty of Oort's galactic rotation (undefined centre, relation to star-cloud structure, interpretation of K-term) is discussed; the author gives more attention to the orbital determination of v. d. Pahlen and Freundlich and the more general considerations of Ogrodnikoff. The author concludes that the existence of a local cluster with individualised structure is certain; the sun not far from its centre; related to other star-clouds, and possibly actually a spiral nebula. He regards all conclusions as to its extent and distance from galactic centre as uncertain. T. L. M.

518. Mean Light Curves of Long Period Variable Stars. R. Leonis minoris. A. A. Nijland. *K. Akad. Amsterdam, Proc.* 35. 7. *pp.* 931–937, 1932. *In German.*—From 592 observations during the years

1905 to 1932, the period of 374 days is deduced for this star's variation, with a maximum of $6^{m}\cdot 72$ and minimum of $12^{m}\cdot 66$. Although the mean curve is smooth, the individual curves often show a more or less marked pause in the ascent, and the height of the maximum is not always the same. M. A. E.

519. Calculation of the Orbit of a Visual Binary. E. Martin. *Accad. Lincei, Atti*, 16. *pp.* 231–236, *Sept.*, 1932.—Another method is given for the calculation of the orbit in which the geometrical elements e, i, ω are obtained independently of a and Ω, the apparent ellipse and the position of the principal or primary star being supposed traced. The conditions imposed do not admit of the simplicity of the first method previously described [see Abstract 4178 (1932)]. J. J. S.

520. Variation of the Eccentricity in the Problem of Two Bodies of Variable Masses. F. Zagar. *Accad. Lincei, Atti*, 16. *pp.* 324–328, *Oct.*, 1932.—Referring to Armellini's papers [see Abstracts 3662 and 4871 (1932)] the author brings forward two particular integrable cases of the problem, one relating to the case of constant eccentricity, the other analogous to the example given by Armellini with the eccentricity always increasing. J. J. S.

521. Orbital Elements of Polaris. A. Belopolsky. *Zeits. f. Astrophysik*, 5. *pp.* 294–296, *Oct.*, 1932.—From radial velocities of this spectroscopic double, determined at different observatories between 1888 and 1932, orbital elements have been deduced and examined to see whether they have altered. It appears that the motion of the system has varied in a period of 32 years, but the mean orbital velocity shows no marked change, the eccentricity varied slightly, and possibly the longitude of periastron also. M. A. E.

522. Spectroscopic Elements of the Eclipsing Variable TX Ursae Majoris. J. A. Pearce. *Roy. Astron. Soc. Canada, J.* 26. *pp.* 382–386, *Nov.*, 1932.—The author's spectroscopic observations of this star in 1924–25 and Hogg's in 1931 have their velocities well represented by Jenka Mohr's period of 3·063295 days (1903–31). The revised elements are $e = 0\cdot 205 \pm 0\cdot 022$; $\omega = 252^\circ\cdot 8 \pm 5^\circ\cdot 27$; T = J.D.2423 856·746 ± 0·044; $\gamma = -10\cdot 1 \pm 0\cdot 62$/km./sec.; $K = 50\cdot 7 \pm 0\cdot 96$ km./sec.; mass function and projected semi-major axis of orbit are $m_2^3 \sin^3 i/(m_1 + m_2)^{-1} = 0\cdot 03888 \odot$ and $a \sin i = 20{,}900{,}000$ km. The smaller, brighter star (type B9) is almost totally eclipsed at principal minimum, and about 6·6 times (if totally eclipsed) as bright as the larger, darker star; the separate apparent magnitudes are 7·05 and 9·1; the combined, 6·89; the orbital inclination is about 75°·7. A. S. D. M.

523. Observations of Eclipsing Variable FV Carinæ. H. L. Alden and E. Whitworth. *Astron. J. No.* 981. *pp.* 89–91, *Nov.* 7, 1932.—This star forms one component of a double, being 8″·4 in P.A.56° from a 13th mag. star to which it is apparently equal at maximum. Plates were obtained near minimum in 1931 by O'Connell and Alden and in 1932 by Whitworth; measures were made by Alden and Whitworth. The magnitudes are to some extent affected in brightness during exposure. The period (which is perhaps variable) is found as 2·111,465 ±000,005 days. A table of adopted magnitudes are plotted against corresponding phases and the curve shows a minimum of 15·85 or a range of 2·95 magnitudes. Minimum occurs at phase 0·4205; the duration of eclipse is about one-fifth of the period, but is ill-defined and it is not decided if it is total. A. S. D. M.

See also Abstracts 505, 506, 507.

SUN.

524. Determination of Accelerations and Fluctuations in Motions of Sun and Moon. J. K. Fotheringham. *Observatory*, 55. *pp.* 305–316, *Nov.*, 1932.—The author traces the history of this research from Halley in 1693 (who attributed the phenomenon to an acceleration of the moon's motion), Dunthorne in 1749 (whose method has remained the standard, of measuring accelerations expressed as the square of the time, in the complete expression of longitude), Laplace in 1787 and the 19th-century astronomers, when opinion settled down in favour of a secular retardation of the earth's motion. In the 20th century he himself introduced ancient observations of occultations (Almagest) as well as ancient eclipses, and from these (confirmed by Schoch) obtained the definitive results of $+ 1''\cdot 5$ per century for solar and $+ 4''\cdot 8$ for (the empirical portion of) lunar acceleration. In 1926 he determined the mean motion in longitude and mean epoch of sun and moon from Greenwich right ascensions of the years 1843–1925, 1750–1778, and 1839–1925, finding the ratio of the moon's fluctuation to the sun's as 9·5 to 1, which was not in agreement with any previous determination nor with gravitational theory, but has been since substantiated by de Sitter from Jupiter's satellites. By including the Ur eclipse of 2283 B.C., he shows that the acceleration has been constant for 4000 years, and he concludes " that the whole apparent motion of the sun within the limits of observational error is now known to be explicable partly by the classical theory and partly by changes in the earth's rotation due to causes which do not enter into that theory." For the moon's mode the author calls for further discussion of all observations, ancient, mediæval and modern. A. S. D. M.

525. Method of Observation of Total Solar Eclipses. P. Salet. *Bull. Astronomique*, 75. *pp.* 173–176, 1932.—The author investigates the consistency of an observation of the duration of totality of the solar eclipse of 28th May, 1900, made at three locations: central, towards the northern and near the southern limit of totality. Regarding it as a question of plane geometry, he finds the results in agreement with the data given in the *Connaissance des Temps* to within 1 km. for the central line position and to within less than 1 sec. for the duration of totality there, and the position of the moon at right angles to its direction of motion to less than $0''\cdot 1$. But the apparent precision is vitiated by the irregularities of the moon's contour, and errors are introduced which do not compensate each other at second and third contacts, so that the theoretical precision is never attained. A. S. D. M.

GEOPHYSICS.

GEOPHYSICS, APPLIED.

526. Magnetic Survey at the Miao-erh-kou Iron Mine, South Manchuria. Y. Fujita. *Kyoto Coll. Eng., Mem.* 7. *pp.* 159–186, *June*, 1932.—The deposits consist of bedded iron ores, chiefly magnetite and hæmatite containing about 33 % iron, but with some ore bodies with 50–67 %, embedded in pre-Cambrian ferruginous metamorphic schists. The ore beds dip at about 45°, and the surface is steep, rising from 1500 to 2850 ft. Horizontal and vertical intensities were determined for more than 1000 stations at intervals of 100 ft. in two perpendicular directions over an area of 215 acres by means of Thalén–Tiberg magnetometers. From these observations isodynamic maps and changes in vertical and horizontal intensity along a series of traverses were prepared. The high vertical anomaly of 4·45 Γ was found at one place. The general topography and the presence of considerable iron in the schists made it difficult to attain definite results, but six places where rich deposits are probable, were located, and indications regarding the probable extension of the deposits worked were obtained. The cost was about 5 dollars per acre. C. A. S.

527. Gravimetric and Magnetic Balance. G. Petrucci. *N. Cimento*, 9. *pp.* 270–276, *Aug.–Sept.–Oct.*, 1932.—Further consideration is given to the precision attainable with the apparatus described previously [see Abstract 4053 (1931)]. Taking into account the accuracy with which the centre of gravity can be set relative to the axis, and also the inductive effect of the earth's magnetic field on the magnet used in the apparatus, it is concluded that it should still be possible to detect variations of 10^{-5} cm. per sec. in g, the acceleration due to gravity. This is about 100 times better than can be obtained with a pendulum, and moreover, an observation with the new apparatus would require only a short time. J. H. A.

528. Seismographic Methods for Determining Crustal Structure. B. Gutenberg, H. O. Wood and J. P. Buwalda. *Seismological Soc. of America, Bull.* 22. *pp.* 185–246, *Sept.*, 1932.—Shots (0·25–60 lbs. of dynamite) are fired at selected points and travel-time curves of the resulting seismic waves recorded by special electromagnetic detectors placed usually along a line through the shot point, and connected electrically to a central point where the seismograms are photographically recorded. The useful waves are the compressional waves reflected from a layer of discontinuity and those refracted into and out of the layer below it. From their travel-time curves, the velocity of transmission in the rocks to be expected, and some knowledge of the geological structure, the position and nature of the different strata, faults, etc., can be inferred. Full details of the method of calculation are given, and it is illustrated by an account of experiments carried out at five places in California, where sedimentary and intrusive rocks occur together. The reflection waves indicate boundaries between rocks of different character down to 10,000 ft., sometimes to 20,000 ft., and the position of faults. Refraction waves enable velocities of transmission to be accurately determined and so give information of the probable

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nature of the rock. The method is valuable where more ordinary methods are not available, but is somewhat costly and requires a special personnel. C. A. S.

See also Abstracts 459, 460.

LAND, PHYSICS OF THE.

529. Earth Rotation and River Erosion. H. L. Fairchild. *Science*, 76. *pp.* 423–427, *Nov.* 11, 1932.—The rotation of the earth causes all moving objects to deviate, the deflection being to the right in the northern and to the left in the southern hemisphere. The suggestion that this deflecting force might produce excessive erosion of the right bank of a river in the northern hemisphere has often been made and accepted on insufficient evidence. On dynamical grounds, it is adduced that the effect of added momentum due to rotation would be dissipated without erosive effect, whilst a study of valley forms in the western part of New York shows that the erosive effect due to the earth's rotation is infinitesimal in comparison with the effect of exposure of the banks to wind. E. L. J.

See also Abstract 548.

METEOROLOGY.

530. Determination of Atmospheric Ozone by Visual Photometry. J. Gauzit. *Comptes Rendus*, 195. *pp.* 892–894, *Nov.* 14, 1932.—A spectrophotometer is described whereby the optical density, and thence the ozone content of the atmosphere, is determined photometrically by means of visual rays of wave-lengths between 6800 and 4900 Å. Thus determined the equivalent thickness of the ozone layer at Montpelier on Jan. 30 and 31 and Sept. 14, 1932, was 0·31, 0·35 and 0·235 cm. ± 10 % respectively [see Abstract 70 (1927)]. C. A. S.

531. Effect of Radiation on Surfaces of Humidity Discontinuity. S. L. Malurkar. *Gerlands Beitr. z. Geophys.* 37. 4. *pp.* 410–415, 1932. *In English.*—The effect of radiation alone on the temperature-height curve in an atmosphere in a steady state is mathematically examined, and it is shown that no discontinuity of temperature, but one of lapse rate, is to be expected at a surface of discontinuity of content of water vapour; if, however, the humidity-height curve only shows a change of slope, the lapse rate also is continuous. C. A. S.

532. Semi-Diurnal Oscillation of the Barometer. L. de Marchi. *Com. Naz. Italiano, Geod. e Geofis. Boll. Nos.* 9–10. *pp.* 145–149, *Sept.–Oct.*, 1932.—In this article, which is reproduced from the author's *Memorie Scientifiche* (Padova, 1932), de Marchi replies to Exner's answer *Dynam. Meteor.*, 2nd edition, Vienna, pp. 409–410, 1925) to his objection to the latter's correlation of the semi-diurnal pressure and temperature oscillations. According to Exner, the semi-diurnal pressure oscillation is a direct consequence of the temperature oscillation of the same frequency. De Marchi points out that, in the Bessel expansions of the diurnal temperature and pressure functions, the second terms in the two cases, which correspond to the semi-diurnal oscillations, have differing degrees of significance. Whereas the temperature variation is very complex, and several terms beyond the second need to be taken into account for a reasonably correct representation, the pressure variation is represented quite adequately by only the first three terms, and even the third term, corresponding to the Rykatcief wave, is relatively negligible. Moreover, the regular variation of

the amplitude of the second term in the pressure expansion with the latitude of the station, and the almost complete independence of the phase angle on the geographical position, show that the second term corresponds to a physical, not a merely numerical, reality in the case of the pressure. The diurnal variations of temperature are, on the other hand, related to a complexity of geographical, meteorological and astronomical circumstances. The third term in the Bessel expansion, for example, is often greater in value than the second. De Marchi hence finds it impossible to accept the theory that the semi-diurnal term of the pressure variation function arises as an oscillation forced by the corresponding wave in the temperature variation function, and has previously submitted an alternative hypothesis.
E. L. J.

533. Formation of Local Thunderstorms. Part II. Processes in the Free Atmosphere above Lindenberg on 2nd and 3rd July, 1932. H. v. Ficker. *Preuss. Akad. Wiss. Berlin, Ber.* 15–16. *pp.* 197–248, 1932. During these two days there was a transition over Germany from anticyclonic to cyclonic conditions. The incoming S.E. wind showed no defined frontal characteristics. A large series of kite ascents at Lindenberg to determine temperature and humidity led to an identification of a tendency for thunderstorms to develop. . The changes from one ascent to the next in temperature, relative and absolute humidity, potential temperature, temperature gradient, and temperature inversion levels and depths are discussed at length, together with the vertical air movements which gave rise to the series of changes. The values of absolute humidity are considered to be of great importance in the identification of air masses, although these may be affected locally by evaporation from the ground. In reviewing the data the cloudless sky on the first day with large surface heating was mainly due to the presence of a strong inversion at 2 km. Small-scale convection occurs first with instability in the lowest layers. This developed into large-scale convection and the inertia of the ascending air column carried it into the inversion layer with a resultant cooling of this layer and a gradual breakdown of the inversion. Advective cooling at 3–4 km. helped to increase the depth of the unstable air mass, while local conditions with damper air favoured the local development of thunderstorms. The large-scale convection can continue in the middle layers during the evening when surface cooling has begun. [See also Abstract 2764 (1932).]
R. S. R.

534. World Weather. Part V. G. T. Walker and E. W. Bliss. *Roy. Meteorolog. Soc., Mem.* 4. *pp.* 53–84, *Oct.*, 1932.—In order to form more definite ideas regarding the oscillations named the North Atlantic, the North Pacific and the Southern, series of figures have been derived to express the variations of each, and from these have been obtained their relations with pressure, temperature and rainfall over wide regions as well as the relations of the three oscillations with each other and with sunspots. The results are set out in a series of tables and diagrams. The southern oscillation in the southern winter is found to be extremely persistent, and its departure has a correlation coefficient of 0·84 with that of the following summer, thus providing a basis for foreshadowing seasonal conditions. The effects of Antarctic conditions and of ocean temperatures are considered but a satisfactory physical basis for the oscillations has still to be found. In an Appendix are tabulated the working values of the departures of the three oscillations and of the centres used in tabulating them in connection with the series of pressure, temperature or rainfall which are most representative of the oscillations. R. S. R.

535. Clouded Atmosphere and Abnormal Extinction. F. W. P. Götz. *Helv. Phys. Acta*, 5. *pp*. 336–340, *Nov*., 1932. *In German*.—The effect on illumination of dust, moisture and so forth in the atmosphere is found to be given by an equation $a = \beta\lambda^{-\alpha}$, where a is the extinction coefficient and β the mistiness-coefficient, the index α characterising the size of the mist particle. A graph shows that α is not constant for clouds and extremely dense clouds, although Rayleigh found it so for pure air. It appears that in the ultra-violet region anomalous extinction takes place, *i.e.*, α is negative, and the logarithm of the intensity of the light plotted against the wave-length λ shows a maximum at the border of the ultra-violet and the visible, moving nearer the visible the greater the cloudiness. H. M. B.

536. Properties of an Optically Turbid Medium. Part III. Illumination of Heterogeneous Curved Layers. Theory of the Crimson Light. P. Gruner. *Helv. Phys. Acta*, 5. *pp*. 351–361, *Nov*., 1932. *In German*.—In an earlier research [see Abstract 4143 (1932)] an equation is obtained for the illumination of narrow, curved, mist-laden layers. The theory is here extended to wide heterogeneous layers, which show varied illumination. The equation, which applies only to primary scattering of light, is used to elucidate the phenomenon of twilight known as the crimson light. The theory is given in a simple manner, and its usefulness is demonstrated by a numerical example. H. M. B.

537. Visible Part of the Auroral Spectrum. L. Vegard. *Zeits. f. Physik*, 78. 9–10. *pp*. 567–575, *Oct*. 18, 1932.—A new spectrograph and results obtained with it on the auroral spectrum are described. A number of new lines show up, particularly two in the red. Although these are near to two neutral oxygen lines, it is considered that the differences between the observed lines and those calculated for neutral oxygen are too great to be accounted for by experimental errors. There are still a number of open questions with regard to the auroral spectrum. J. E.

See also Abstracts 558, 628.

SEISMOLOGY.

538. P- and S-Curves Deduced from the Tango Earthquake, Japan, March 7, 1927. E. A. Hodgson. *Seismolog. Soc. of America, Bull*. 22. *pp*. 38–49, *March*, 1932.—The corrected time of the Tango earthquake of March 7, 1927, is 9 h. 27 m. 46 s. G.M.T., and focal depth 12 km. From the arrival times of the P- and S-waves as recorded at 59 and 57 stations respectively, at epicentral distances of 1·3–97·6° P- and S-curves and a revised smooth P-curve have been deduced. Compared with Mohorovičič's curve for the P-wave, transmission times are greater for distance $< 20°$ (due possibly to the shallow focus) and $> 57°$, less for 20°–57°. The S-curve shows no systematic differences, such as there are being within the limits of error [see following Abstract]. C. A. S.

539. Two Probability Methods for Determining Earthquake Epicentres. E. A. Hodgson. *Gerlands Beitr. z. Geophys*. 37. 4. *pp*. 390–409, 1932. *In English*.—Two modifications of Geiger's probability method [see *Nach. K. Ges. d. Wiss., Göttingen, May*, 1910] are worked out in detail; both depend on data from stations of which the epicentral distance is such that the arrival time curve of the longitudinal wave may be deemed rectilinear. The first depends both on arrival times and macroseismic data, the second only on microseismic data. The methods applied to the Tango earthquake of March 7, 1927, give for the epicentre the positions 134° 58·2′ E., 35° 36·4′ N. and 134° 50·4′ E., 35° 47·7′ N., with velocities of the longitudinal wave in the subcontinental layer of 7·75 and 7·41 km./sec. respectively. The result of the first method is in better agreement with macroseismic data. [See preceding Abstract.] C. A. S.

540. Damping of Seismographs. A. Proviero. *Accad. Lincei, Atti*, 16. *pp.* 237–242, *Sept.*, 1932.—The writer deals with criticisms made by E. Oddone (*Boll. d. Soc. Sism. It.*, 30. 1931–1932, *fasc.* 3–4) against the employment of a small Agamennone seismograph, with free pendulums, by the R. Ufficio Centrale di Meterologia e Geofisica at Rome. In reply to Oddone's contention that the seismograph records can only represent the ground undulations with reasonable fidelity when the pendulums are damped, the author contends that, with due allowance for the free periods of the system, intelligible records can be obtained with undamped pendulums. Moreover, the theory of damping is at best only imperfectly understood, and the approximations in vogue introduce serious errors in interpretation of the records. The author claims that by the use of dissynchronisation between the free periods of the system and those of the ground vibrations, very reliable indications are obtained of certain telluric waves, and the formulæ for dynamic magnification are much more readily and reliably obtained than in the use of damped pendulums. E. L. J.

See also Abstract 454.

TERRESTRIAL ELECTRICITY AND MAGNETISM.

541. Atmospheric Electricity. Return Shock. E. Mathias. *Comptes Rendus*, 195. *pp.* 844–846, *Nov.* 14, 1932.—This note deals with the classical case of death supposed to be due to return shock and referred to by Brydone, *Phil. Trans.* 1776, p. 61. The theory to account for this phenomenon, suggested by Mahon, is considered to be inadequate. But if one supposes that the discharge from a positive cloud neutralises the negative electricity induced in living bodies, then an explanation of the above phenomenon can be found: also of other extraordinary phenomena observed at the same time as the above. The author also criticises the experimental method used by Mahon to demonstrate the effects of a thunder cloud. He points out that in the method the distribution of electricity is very different from what it is on Simpson's theory, and that the effects of a thundercloud must be very different from those suggested by Mahon. A. E. M. G.

542. Eclipse of the Sun of 31st August, 1932, and Sounding by Atmospherics. J. Lugeon. *Comptes Rendus*, 195. *pp.* 817–819, *Nov.* 7, 1932.—The author recalls the essential features of these atmospherics, times of maxima and cause. Registrations of them on a 11,000-m. wave at Jablonna, Tromsö and Bjornoya are being made during the Polar year. The registrations at Jablonna showed the same features of increase of atmospherics during this eclipse as at twilight and the focus of maximum frequency lay along the line of totality in N. America. This confirmed the views advanced earlier by the author regarding the formation of these atmospherics [see Abstract 3499 (1929)]. The conditions at Tromsö and Bjornoya were less favourable for observation on account of daylight. R. S. R.

543. Effect of Recent Solar Eclipse on the Ionised Layers of the Upper Atmosphere. J. P. Schafer and W. M. Goodall. *Science*, 76. *pp.* 444–446, *Nov.* 11, 1932.—The phenomena observed at Deal, N.J., before, during and after the solar eclipse of 31st Aug., 1932, were similar to those observed from about 2 hours before sunset, and for 2 hours after sunrise. The times of occurrence of the changes indicate that at least one ionising agency effective in the lower layer consists of ultra-violet light, and not of neutral particles. C. A. S.

544. Consequences of the Classical Deviation Theory. H. Meldau. *Terr. Mag.* 37. *pp.* 309–315, *Sept.*, 1932. *In German.*—The author reviews the classical theory for the deviations of the magnetic compass, and the methods used for the compensation of the ship's compass. Induction in the magnetic needle is investigated, and a method is suggested by which this is made largely responsible for quadrantal deviation. Methods of test are described. R. S. R.

545. Distribution of Mass in Marine Compasses. W. J. Peters. *Terr. Mag.* 37. *pp.* 317–320, *Sept.*, 1932.—Reference is made first to earlier methods used in the design of marine compasses to equalise the moment of inertia about the horizontal axis of the card. Finally, a detailed analysis is given of the method which can be followed in designing the compass for non-magnetic or only slightly magnetic vessels or a vessel of moderate deviation having a specially prepared non-magnetic region or for non-magnetic towing devices. In these cases the most rigid specifications practical for the proper distribution of mass can be followed, and only in very exceptional cases will conflict materially with the proper distribution of the magnetic field. R. S. R.

546. Explanation of Echoes in Space, Auroræ and Magnetic Storms. Part I. H. Dostal. *Ann. d. Physik*, 14. 8. *pp.* 971–984, *Oct.*, 1932.—The author reviews the facts regarding echoes from space in the use of short-wave radio-transmissions, and particularly those from Eindhoven (Holland). He examines critically the conception of Störmer regarding the spiral paths followed by electronic bundles emitted by the sun, and giving rise to various auroral forms in the earth's upper atmosphere [see Abstract 1325 (1932)], and finds it insufficient to explain echoes from space. The intensity of the echoes indicates that the reflected rays are focussed. By a geometrical construction the required shape of the reflecting surface is obtained. This is applied at Eindhoven, and the probable dimensions and height of the reflecting band are given. In a later communication the kind of reflecting band, its formation and the emission from the sun which causes it are to be treated. R. S. R.

547. Space Charge in Relation to the Chemical Constituents of the Atmosphere. R. Stoppel. *Zeits. f. Physik*, 78. 11–12. *pp.* 849–853, *Oct.* 28, 1932.—The phenomenon of the daily periodic discharges in short-circuited electrometers [see Abstract 4462 (1932)] has been studied in various gases; and it is shown that variations of temperature in no way account for the fluctuations of the needle. A. D.

See also Abstract 533.

RADIOACTIVITY.

548. Radium in Hungarian Rocks. S. S. de Finály. *Am. J. Sci.* 24. *pp.* 306–310, *Oct.*, 1932. *Paper read before the Hungarian Academy of Sciences.*—Various Hungarian rocks were chemically analysed and examined for radium content by Bamberger and Mache's solution method. The results are summarised as follows: Granites containing $1 \cdot 43$ to $3 \cdot 69 \times 10^{-12}$ gm. Ra per gm., averaging $2 \cdot 50 \times 10^{-12}$. Andesites averaging $1 \cdot 96 \times 10^{-12}$ gm./gm. Basalts averaging $1 \cdot 70 \times 10^{-12}$ gm./gm. E. E. F. d'A.

549. Period of Radium. Ellen Gleditsch and E. Foyn. *Am. J. Sci.* 24. *pp.* 387–393, *Nov.*, 1932.—The paper describes an experimental determination of the decay constant of radium. The experiment consists in the separation of ionium from the Norwegian mineral broeggerite, and the comparison of the amounts of radium produced by the ionium in known periods with the amount of radium originally associated with it. The result agrees closely with a previous determination made by one of the authors [Abstract 331 (1916)]. W. E. P.

550. Average Life of Activated Atomic Nuclei: Probable Cases of Impossibility of γ-Ray Emission. F. Perrin. *Comptes Rendus*, 195. *pp.* 775–778, *Nov.* 7, 1932.—In view of the fact that oscillation of one part of a nucleus involves oscillation of the remainder, it is shown mathematically that the mean life of a state, *e.g.*, of RaC′, is much greater than hitherto supposed. Nuclei consisting of helions, Be^8, C^{12}, etc., or of helions and demihelions, Li^6, B^{10}, etc., ought not to emit γ-rays. [See also Abstracts 899, 4379 and 5064 (1932).] C. A. S.

551. Origin of the Actinium Series of Radioactive Elements. A. v. Grosse. *Phys. Rev.* 42. *pp.* 565–570, *Nov.* 15, 1932.—Data on the actinium series gathered from carefully selected material have been correlated. It can be definitely concluded from these data that the actinium series is independent and the decay much more rapid than in the uranium-radium series. The significance of this fact for geology (age determinations, heat evolution) is pointed out. AUTHOR.

552. Variation with Temperature of the Total Number of Conducting Carriers in Air. A. Becker and Ilsemarie Schaper. *Zeits. f. Physik*, 79. 3–4. *pp.* 186–193, *Nov.* 14, 1932.—The variation with pressure of the conductivity of air, ionised by α-rays from polonium, is investigated between $-80°$ C. and $+250°$ C. and discussed. J. S. G. T.

553. β-Rays of Active Deposit of Actinium. S. Y. Sze. *Comptes Rendus*, 195. *pp.* 773–775, *Nov.* 7, 1932.—With the ThB line Hρ 1398 as standard, Hρ and the energies and origins of the groups in the β-ray spectrum of this deposit have been determined. The results differ substantially from those of Hahn and Meitner [see Abstract 777 (1926)]: three groups, Hρ 2418, 2670 and 2772, were not found; two, 2149 and 2456, are due to the transition $AcB \xrightarrow{\beta} AcC$, and three, 1953, 2252 and 2304, to $AcC \xrightarrow{\alpha} AcC''$. [See also Abstract 4387 (1932).] C. A. S.

554. γ-Rays of Thorium B and of the Thorium C Bodies. C. D. Ellis. *Roy. Soc., Proc.* 138. *pp.* 318–339, *Nov.* 1, 1932.—The author has made a comprehensive remeasurement of the β-rays lines of thorium B and thorium C using the semicircular focussing method and improved technique, notably the use of a permanent magnet. Several interesting relations between the energies are discussed. A careful measurement has been made of the relative intensities of the lines, and an attempt has been made to assign the γ-rays to the various disintegrating bodies. The energies of selected strong β-ray groups have been determined absolutely and are found to be about 0·7 % lower than those which had previously been accepted. The paper contains a large amount of tabulated data.
J. E. R. C.

555. Penetrating Power of Radiation (Neutrons) Produced from Beryllium by α-Particles. J. Thibaud and F. D. la Tour. *Comptes Rendus*, 195. *pp.* 655–657, *Oct.* 17, 1932.—The log I_x/x curve is convex to the axis of x only if the aperture closed by the lead screen is small, with a large aperture it is concave; this is attributed to the less penetrating neutrons being most strongly dispersed by the lead. A narrow aperture (2·5–3·0 cm.) should therefore be used for the determination of the coefficient of extinction, μ. This gives for recoil atoms producing 8000–10,000 pairs of ions the approximate relation $\mu = 0 \cdot 3/\sqrt{x}$, a result which is explicable either by the neutrons having a continuous spectrum of velocities, or by their consisting of two principal components having coefficients $\mu_1 = 0 \cdot 040$, and $\mu_2 = 0 \cdot 065$. The particles producing more than 22,000 pairs of ions (N nuclei) are unaffected by thicknesses not exceeding 7–8 cm. of lead, but with greater thicknesses their number falls rapidly. Extinction in mercury is similar to that in lead, but for that in medium and light elements the curve is almost a straight line. μ_{at} for screens of Sn, Fe, S and Al containing the same numbers of atoms shows little variation with atomic number. [See Abstract 3799 (1932).]
C. A. S.

556. Passage of Neutrons through Matter. H. S. W. Massey. *Roy. Soc., Proc.* 138. *pp.* 460–469, *Nov.* 1, 1932.—Born's quantum theory of collision [see Abstract 43 (1927)] is applied to elastic collisions between neutrons and heavy and light nuclei, protons, and electrons, the neutron being regarded as a hydrogen atom in a nearly zero quantum state, *i.e.*, as an atom in which the electron moves in a field of very high effective nuclear charge (> 25,000). It is hence inferred that the radius of the neutron is $< 2 \times 10^{-13}$ cm.; that a proton does not behave as a unit charge for distances $< 10^{-13}$ cm., or else that the energy of interaction between neutrons and nuclei at large distances increases less rapidly than the nuclear charge in passing from element to element; and that the probability of disintegration of a neutron by nuclear impact is very small. The distribution per unit angle of protons struck on this theory is compared with that which supposes the neutron to behave as a dipole, and a method for deciding between them is suggested.
C. A. S.

557. Use of the Wilson Cloud Chamber for Measuring the Range of α-Particles from Weak Sources. F. N. D. Kurie. *Rev. Sci. Instruments*, 3. *pp.* 655–667, *Nov.*, 1932.—A large Wilson cloud chamber operated by a synchronising mechanism similar to that used by Blackett is described. It is shown how, by the use of mirrors, it is possible to take two photographs of the whole volume of the cloud chamber with a single lens, which are equivalent to photographs taken by two cameras at right angles. The design of such a camera is discussed in detail. The photographs are examined by replacing the developed film in the camera and using it as a projection apparatus. The two images can be combined on a suitably oriented plate as one image the same size as the original track. The method is thoroughly tested by photographing glass fibres and by range determinations. The reduction of the track lengths in the chamber to α-particle ranges under standard conditions is discussed fully. It is shown that the interval between expansions must be made much longer than is customary if precision is to be attained in this reduction. The temperature in the chamber is carefully examined throughout the single cycle and repeated cycles to determine this interval and other thermal conditions of operation. The whole technique has been developed with the aim of utilising as many tracks per expansion as possible for the purposes of range measurement. AUTHOR.

558. Point Discharge Method of Measurement of the Radioactivity of the Atmosphere. G. Aliverti. *Accad. Sci. Torino, Atti,* **67. 14–15.** ***pp.*** **376–385, 1931–1932.**—A current of air is sent up a hollow metal tube containing a cylindrical insulated electrode at its upper end, the electrode being surrounded by five bands of metal points fixed to the inner wall of the tube. By means of a transformer and rectifiers, the inner electrode is raised to a potential of 7–8 kV. A certain fraction of the total number of particles of radioactive matter present in the air are deposited on the electrodes. To determine the efficiency of the collector, a second similar collector is inserted lower in the tube. The ratio k of the two activities is determined as a function of the velocity ϕ of the air current. Observations are made with velocities ranging from 1 to 5 litres per sec. Between the limits of 1 and 2·5 litres per sec., the relation between k and ϕ is linear; the curve would probably pass through the origin, while at higher values of ϕ, k gradually approaches unity. The optimum conditions for the experimental arrangement are determined; k is found to be independent of the distance between the two collectors, showing that there is no appreciable loss of radioactive material by diffusion to the walls of the apparatus. The air current is passed for about 1000 sec.; the electrode is subsequently examined in an ionisation chamber. By analysis of the decay curves of the radioactive material collected, the relative amounts of Ra to Th emanation present can be determined. F. C. C

See also Abstracts 419, 578, 714.

RADIATION.

ABSORPTION AND TRANSMISSION.

559. Optical Transmission of Cu_2O in Relation to its Electrical Conductivity. G. Mönch. *Zeits. f. Physik*, 78. 11–12. *pp.* 728–733, *Oct.* 28, 1932.—The short-wave limit of optical transmission was determined for a number of specimens of Cu_2O over various temperature ranges between −50° and +300° C. The position of the short-wave limit was independent of the specimen (average position, 638 mμ at 20° C. for a 1 mm. layer) and the temperature coefficient of the absorption edge was also found to vary very little with the specimen. No correlation was observed between the electrical conductivity of the specimen and the position of its absorption edge. On the other hand, the variation in electrical conductivity with change of oxygen content of the Cu_2O implies a structural change in the Cu_2O which should give rise to variations in the absolute magnitude of the optical transmission. Such changes were found to occur, increase in oxygen content resulting in an increased optical transmission for white light. W. S. S.

560. Colours of Inorganic Salts. M. N. Saha and S. C. Deb. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 1–18, 1931–1932.—The various theories regarding the origin of the colours shown by certain inorganic salts are discussed. The hypothesis is put forward that in the case of elements of the transitional groups the colours of the salts are due to the electrons of the *d*-shell. The absorption spectrum of $CrCl_3$ vapour between 1200° C. and 1350° C. is studied, the spectrum being photographed from λ5000 to λ2400 by a Hilger E1 spectrograph. Two band systems are observed at 22654·5 cm.$^{-1}$ and 22545·1 cm.$^{-1}$ respectively, vibrational analyses being made in both cases, whilst an absorption continuum is observed to commence near λ3000. The terms of CrIV are studied and it is concluded that the band absorption of $CrCl_3$ is certainly due to the reaction of light on the *d*-shell of the CrIV-ion. A. H.

See also Abstracts 561, 562, 653.

ELECTRO-OPTICAL AND MAGNETO-OPTICAL EFFECTS.

561. Anomalous Circular Magnetic Dichroism and Rotatory Dispersion of $CoCl_2$ Solutions. A. Cotton. *Comptes Rendus*, 195. *pp.* 915–919, *Nov.* 21, 1932.—The only known case of magnetic dichroism with liquids having wide absorption bands has been till now that of colloidal ferric hydroxide, studied by Mouton and the author [Abstract 2059 (1907)]. Now that more powerful fields are available there is no doubt that many solutions showing wide bands such as $CoCl_2$ will show magnetic dichroism. The author finds that the course of the magnetic rotatory dispersion curves of Schérer [see following Abstract], which are in accord with some results previously obtained by himself, is explicable by supposing that the two privileged circular vibrations have the same spectral position, but that the two curves representing h'/λ and h''/λ are modified by absorption and have a point of inflection where this is a maximum. The curves of Schérer mark a new advance, since not only have his measurements been made in a region of strong absorption but with a strong field and with many wave-lengths. These curves recall those obtained with naturally active dichroitic liquids. The generally accepted idea that the anomalies found by Schérer are confined to paramagnetic atoms is considered premature. It is now known that negative rotations are obtained with diamagnetics. The question is raised as to whether the ratio $d\rho/d\lambda$ has always opposite signs on either side of an absorption band, and the need for further experiment is indicated. J. E.

562. Anomalous Circular Magnetic Dichroism and Rotatory Dispersion of $CoCl_2$ Solutions. M. Schérer. *Comptes Rendus*, 195. *pp.* 950–952, *Nov.* 21, 1932.—The curve of dichroism has a maximum at 510 $\mu\mu$ and is not symmetrical about this point. The ellipticity decreases very rapidly outside the band as is the case with natural circular dichroism. The curve of rotations has a point of inflection at 510 $\mu\mu$ (the maximum absorption). The rotation has a negative sign for waves less than 505 $\mu\mu$ and is positive on the long-wave side of the absorption band, the positive maximum being greater than the negative. [See also preceding Abstract.] J. E.

563. Mixture Rule for the Electromagnetic Rotation of the Plane of Polarisation. O. Schönrock. *Zeits. f. Physik*, 78. 11–12. *pp.* 707–721, *Oct.* 28, 1932. *From the Reichsanstalt.*—The mixture rule in question is an expression for the Verdet constant of a solution as a linear combination of the Verdet constants of the solvent and the solutes. The author discusses the exact formulation of the rule and the experimental data necessary to establish whether it is valid in any particular case. The measurements of Pillai, and Pfleiderer are discussed and their conclusions involving the mixture law are shown to be incorrect. W. S. S.

564. Faraday Effect of Electrolytes in Aqueous Solutions. E. B. Andersen and R. W. Asmussen. *J. Phys. Chem.* 36. *pp.* 2819–2831, *Nov.*, 1932.—Measurements of the Faraday effect for a single wave-length are given for 43 aqueous solutions of simple inorganic compounds. The molecular rotation (relative to water) can be computed approximately by adding together the rotations of the ions in question, these being deduced on the basis of zero rotation for the hydrogen ion. All the ions thus considered are univalent. The measurements are extended to 42 further solutions with ions containing oxygen and sulphur. Large variations of molecular rotation with change of concentration are observed, so that only tentative correlation of rotation with constitution is attempted. C. B. A.

See also Abstracts 567, 584.

FLUORESCENCE AND PHOSPHORESCENCE. LUMINESCENCE AND AFTERGLOW.

565. Fluorescence of Silicates under Kathode Rays. H. Peters. *Zeits. f. Elektrochem.* 38. *pp.* 885–886, *Nov.*, 1932.—A polemical discussion of a recent paper by Bruninghaus [see Abstract 1609 (1932)], who attributes fluorescence to the reflection colours of an impurity in a transparent parent substance. The author maintains that pure quartz fluoresces red. Bruninghaus accounts for the transition from red to green fluorescence of manganese-containing silicates by a very slow reduction of the oxide. The author points out that spectroscopic evidence is against the presence of free oxygen which this assumption implies and further that a sample which under long bombardment with fast kathode rays has been fluorescing green will afterwards under slow rays be red. J. E.

566. Absorption of Iodine Fluorescence in Iodine Vapour. I. I. Agarbiceanu. *Comptes Rendus,* 195. *pp.* 947–949, *Nov.* 21, 1932.—A study of the spectral absorption of iodine fluorescence in iodine vapour at different temperatures. The results seem to show that the distribution of the molecules in the various energy levels according to the Maxwell–Boltzmann law does not account for the variation of absorption of various lines with temperature, but that the probability of transitions from one level to another are affected by temperature. It is further found that the presence of foreign gases increases the absorption, which is taken to support Turner's hypothesis as to the increase of the probability of predissociation by collisions. J. E.

567. Quenching of Iodine Fluorescence by Magnetic Fields and Foreign Gases. W. Berg. *Zeits. f. Physik,* 79. 1–2. *pp.* 89–107, *Nov.* 4, 1932.—The molecular intensity of iodine fluorescence excited by white light has been measured as a function of the pressure with and without magnetic fields. A magnetic field should act like a foreign gas. This is not the case. Besides the expected quenching by the field there is an increase of the collision radius. The quenching by N_2, O_2 and A, with and without a magnetic field, shows again an increased collision radius. The experiments as a whole indicate that the effects of pressure and foreign gas or magnetic field do not as a rule add up in the Stern–Volmer sense. J. E.

568. Influence of Collisions on the Time of Decay of Na Resonance Radiation. F. Duschinsky. *Zeits. f. Physik,* 78. 9–10. *pp.* 586–602, *Oct.* 18, 1932.—The time of decay has been measured with a Gaviola fluorometer. An extinguishing gas like nitrogen decreases the excited life while a gas like helium, which has no quenching effect, does not affect the life of the excited atoms. From 170° C. upwards Na shows an increase of the excited life time, attributed to imprisoned radiation. The D fluorescence exhibits a definite time of decay, showing that it cannot be simply scattered radiation. A short discussion is given on the advantage of substituting a quartz oscillator for the Kerr cell in the fluorometer. J. E.

See also Abstract 634.

INTERFERENCE. DIFFRACTION AND SCATTERING.

569. Optical Properties of Solids and Liquids under Ultrasonic Vibrations. R. Lucas and P. Bicard. *J. de Physique et le Radium,* 3. *pp.* 464–477, *Oct.,* 1932.—When certain solids and liquids are subjected to vibrations of frequencies from 600 to 30,000 kc, obtained by Langevin's piezoelectric quartz method, different optical phenomena appear according to the aperture of the luminous beam and the lengths of the optical and elastic waves. When the elastic waves are a few mm. in length diffraction phenomena similar to those of a grating are observed. At greater lengths a spreading of the beam is observed corresponding to a mirage effect. E. E. F. d'A.

570. Extension of Woo's Formula. Intensity of the Light Diffused by an Electron in Motion. C. Cannata. *Accad. Lincei, Atti,* 16. *pp.* 328–333, *Oct.,* 1932.—A study is given of the intensity of a radiation by electrons free and movable in any way. This calculation has been made by Woo in the particular case in which the diffusing electron moves in the same direction as the incident beam. The author using a method substantially analogous to that of Woo, but simpler, confirms his result, and then extends it to the case in which the diffusing electron moves in any direction. J. J. S.

See also Abstracts 469, 492, 536, 586, 589, 649, 679.

PHOTOCHEMISTRY (INCLUDING PHOTOGRAPHY).

571. Intensity of Incident Light and Velocity of a Photochemical Reaction. W. V. Bhagwat. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 54–59, 1931–1932.—Assuming the same fraction of the molecules still inactive to be activated by equal increments of intensity I of light, it is shown mathematically that if the photochemical acceleration is small the velocity, $V \propto I$, but with increasing acceleration $V \propto I^n$ where n is < 1, or even $< \frac{1}{2}$. V will probably vary as I when absorption of radiation is high, the reaction not markedly photochemical and its velocity in the dark considerable, but will vary as $I^{\frac{1}{2}}$ or a lower power if the reverse is the case.
C. A. S.

572. Photochemistry of Phosphine. H. W. Melville. *Roy. Soc., Proc.* 138. *pp.* 374–395, *Nov.* 1, 1932.—Under the action of Hg arc radiation from which all wave-lengths below 2400 Å have been removed, PH_3 decomposes into P and H_2, practically no P_2H_4 being formed. The reaction velocity decreases with time, owing to the deactivation of the excited (2^3P_1) Hg atoms by the accumulated H_2. The primary process is dissociation of the PH_3 molecules by collision with excited Hg atoms into atomic H and a residue of, probably, PH_2. Recombination may occur at the walls of the vessel, but separate experiments show that no PH_3 is formed from atomic H and P vapour. Introduction of O_2 causes first retardation of the reaction, and then the initiation of a chain reaction between the remaining PH_3 and O_2. H_2 molecules are formed, probably, from H atoms at the walls, and possibly also in reactions between PH_2 or PH radicals. The decrease of the explosion pressure of PH_3–O_3 mixtures which have been irradiated has its origin in a surface effect, and is probably concerned with the adsorption of H atoms, resulting from the primary decomposition of PH_3, on the walls of the vessel. The observed decay of the effect is attributed to the impact of O_2 molecules on the surface. H. F. G.

573. Actinic Measurement by Sensitometric Methods. O. Reeb. *Phot. Indust.* 30. *pp.* 1147–1149, *Nov.* 23, 1932.—Describes a sensitometric method whereby it is possible to obtain actinic values of different light sources when used with various types of plates. A photographic comparison is made between the normal vacuum tungsten lamp run at a colour temperature of 2360° K. and used with the Davis–Gibson filter, and the lamp under test. Two wedge photographs, one immediately below the other, are obtained, and the distances of points at which the blackening is 0·1 greater than the development fog are measured and the relative actinity thereby obtained. The apparatus used is described and results given for different types of illumination with extra-rapid and orthochromatic plates. A comparison with results obtained by Bloch is also made possible by expressing the results obtained in terms of a vacuum lamp of 10 lumens per watt instead of using the normal sensitometric lamp as the basis.
R. C. F.

574. Reflection Densitometer for Photographic Papers. C. W. Kendall. *Rev. Sci. Instruments*, 3. *pp.* 668–674, *Nov.*, 1932.—A densitometer is described based on that used by Jones [see Abstract 1730 (1927)]. The blackened paper under examination and an unexposed (but similarly processed) piece are illuminated by light incident at 45° and the samples are compared by observation along the normals to their surfaces by means of a Lummer–Brodhun cube. The inverse-square principle is employed, the illuminating lamp being moved between the two surfaces until equality is obtained. A. H.

PHOTOMETRY.

575. Method of Measuring the Maximum Intensity of Light from Photoflash Lamps or other Sources of Short Duration. W. E. Forsythe and M. A. Easley. *Rev. Sci. Instruments*, 3. *pp.* 488–492, *Sept.*, 1932.—The flash of light is allowed to fall on a very sensitive cæsium photoelectric cell, which, operating on the grid of a triode, causes the plate current to charge a condenser. It is necessary for the peak voltage to remain on the condenser, and hence some form of interrupter must be used. Various forms of rectifying valve were tried, but finally a special key, which opened just after the flash of the lamp, was adopted. This arrangement gives results in agreement with those obtained photographically, but has the advantage of being quicker in action. G. E. B.

See also Abstracts 530, 582.

POLARISATION.

See Abstract 576.

RADIATION, EMISSION.

576. Variation with Angle of Emission of the Radiation from Metals Bombarded by Slow Electrons. C. Boeckner. *Bureau of Standards, J. of Research*, 9. *pp.* 583–591, *Nov.*, 1932.—The radiation from Pt and W, with its electric vector parallel to the plane of emission, increases rapidly with increasing emission angle. For the other direction of polarisation the radiation varies only slowly with angle. The variation is given by the function $(1-R_\theta)/\cos\theta$, where R_θ is the reflection coefficient of the metal for light incident at angle θ. A discussion of the variation of emission from surface layers with angle is given, based on T. C. Fry's theory of lamellar absorption. The disagreement with the observed variation is in the direction to be accounted for if the radiation is initially emitted anisotropically (in a manner similar to the continuous X-rays) and is later modified by refraction effects. It is shown that the angle variation is somewhat similar to that expected for the inverse vectorial photoelectric effect. AUTHOR.

577. Influence of Cold Working on the Temperature of the Commencement of Grayglow. G. Tammann, F. Neubert and W. Boehme. *Ann. d. Physik*, 15. 3. *pp.* 317–320, *Nov.*, 1932.—The authors point out that hitherto it was not known that cold working greatly lowers the temperature of the commencement of the grayglow, and that after sufficiently increasing the temperature this lowering disappears and the temperature of the grayglow is the same as for the unworked material. In the case of gold which has been rolled, the lowering is about 8° C., but in the case of crushed salts it may be as much as from 50° to 150° C. Heating the salt to a temperature above that at which the grayglow appears causes the temperature at which the grayglow will appear to rise to that of the ordinary material. The temperature of the grayglow depends on the duration of the crushing. A table is given for thirty salts showing their melting-point temperature of grayglow after three separate heatings and their temperature of atom displacement in the lattice ("Platzwechsels"). AgCl is the only salt in the list which permits of rolling, and this shows a drop of 97° in the temperature of the grayglow. T. B.

578. Cosmic-Ray Ionisation as a Function of Pressure, Temperature and Dimensions of the Ionisation Chamber. J. W. Broxon. *Phys. Rev.* 42. *pp.* 321–335, *Nov.* 1, 1932.—Experiments have been performed to test the adequacy of the writer's explanation of the dependence upon pressure of the cosmic-ray ionisation in gases at high pressures in terms of subsidiary radiations emitted solely from the walls of the ionisation chamber. The ionisation in a 436-c.c. sphere of 33·32 gm. mass located at the centre of the 660-lb. bomb of 13·8 l. capacity used in previous experiments [see Abstract 1322 (1932)] was found not to differ greatly from the average ionisation in the large chamber at corresponding pressures up to 175 atmospheres. At the higher pressures γ-ray ionisation and cosmic-ray ionisation were found to vary with the pressure in the same manner. These facts are considered to be incompatible with the explanation mentioned above. The temperature effect was found to amount to 0·19 % increase in ionisation per ° C. increase in temperature at a mean pressure of 23·3 atmospheres, and 0·27 % per degree at 162·1 atmospheres, in qualitative but not entirely in quantitative agreement with the theory and observations of Compton, Bennett and Stearns. The cosmic-ray ionisation at 205 atmospheres in the shielded bomb was found to agree within about 1 % with the upper limit previously observed in the same chamber with similar shielding at pressures between 130 and 170 atmospheres. Certain transient effects associated with changes in pressure and temperature were observed. AUTHOR.

579. Electrons as Cosmic Rays. W. F. G. Swann. *Frank. Inst., J.* 214. *pp.* 597–599, *Nov.*, 1932.—A discussion of the possibility of cosmic rays being electrons. For the most favourable direction of projection in the magnetic equatorial plane at infinity an electron would have to possess 10^{10} volts velocity in order to reach the earth's surface. There is evidence that electrons of energy comparable with this amount may be incapable of ionising. For such electrons, considered as primary cosmic radiation, the action of ionisation would have to occur through the intervention of secondaries shot out only occasionally by the primaries. The operation of the primaries would thus become more closely comparable with that characteristic of photons. J. J. S.

580. Particle Ionisation for Velocities Approaching that of Light. W. F. G. Swann and A. Bramley. *Frank. Inst., J.* 214. *pp.* 606–608, *Nov.*, 1932.—Calculations have been made by Carlson and Oppenheimer and by Williams which predict that for high-speed particles the ionisation should increase indefinitely as the velocity of the β-particle approaches the velocity of light. Considerations which on the classical theory would be concerned with the radiation reaction on the electron ejected in the ionisation are, however, neglected. Swann has given reasons for supposing that, taking into account the effect of radiation on the classical theory, ionisation should cease at electron energies of the order of 10^9 volts. In this paper calculations based on wave mechanics are given, and these lead to the conclusion that the ionisation decreases practically to zero when the speed of the β-particles becomes of the order of 10^{10} to 10^{11} electron volts. An experimental decision as to whether ionisation does decrease for very high energy β-particles is a problem of profound interest in connection with possible ionisation by cosmic rays considered as electrons of sufficiently high energy to reach the earth at the equator in opposition to the earth's magnetic field. J. J. S.

581. Magnetic Spectrum of Ultra-Penetrating Radiation. P. Kunze. *Zeits. f. Physik*, 79. 3–4. *pp.* 203–205, *Nov.* 14, 1932.—An expansion cloud chamber is placed in a magnetic field of about 18,000 gauss, produced by a copper-wound air bobbin absorbing 500 kW and weighing 1100 kg. In a total of 80 tracks 59 showed a measurable curvature. Most of the uncurved tracks were short and blurred. A few of the long and sharp tracks of very small curvature, if due to electrons, must correspond to those with energies of about 10^{10} volts. Positive and negative curvatures occur with about equal frequency. Some tracks occur in pairs, others in threes. The energy spectrum is continuous, and there are no maxima or minima. The number of particles of extremely high energy is very small, but the number increases fairly rapidly around 10^9 volts, and below 5×10^8 volts the increase is very marked. F. C. C.

582. Quartz Capillary Arc Lamps of Bismuth, Cadmium, Lead, Mercury, Thallium and Zinc. R. M. Hoffman and F. Daniels. *Am. Chem. Soc., J.* 54. *pp.* 4226–4235, *Nov.*, 1932.—A simple mercury lamp of high intensity has already been described [see Abstract 4259 (1932)]. A description is now given of a quartz capillary lamp suitable for metals other than mercury. The capillary portion of this lamp can only be used once, but the lamp as a whole is inexpensive to make so that it can be discarded upon the conclusion of an experiment. A suitable electrical circuit for use with the lamp is described. By means of a Hilger quartz monochromator the distribution of energy in capillary arcs of bismuth, cadmium, lead, mercury, thallium and zinc is determined. The lamp should be useful in photochemical research in that it makes available an intense source for a wide selection of wave-lengths. A. H.

See also Abstract 590.

RADIATION, GENERAL THEORY.

583. Huygens' Principle. J. S. Mitchell. *Phil. Mag.* 14. *pp.* 938–939, *Nov.*, 1932. *Supplement.*—The well-known theorem of Kirchhoff (*Ann. d. Phys. u. Chem.* xviii, p. 663 (1883)), generally accepted as a rigorous formulation of Huygens' principle, can be derived shortly by an application of Fourier's integral theorem, somewhat similar to Schott's treatment of the electromagnetic potentials in his book "Electromagnetic Radiation." AUTHOR.

See also Abstracts 481, 486, 797.

REFLECTION, REFRACTION AND DISPERSION.

584. Change of Reflectivity of Bismuth due to Magnetisation. E. Englert and K. Schuster. *Zeits. f. Physik*, 79. 3–4. *pp.* 194–196, *Nov.* 14, 1932.—In confirmation of the result obtained by McLennan, Allin and Burton, no change of the reflectivity of polycrystalline bismuth for radiation of wave-length 9 μ is found to occur in magnetic fields of strength up to 17,000 gauss. [See also Abstract 4895 (1932).] J. S. G. T.

585. Refraction of Gaseous Acetaldehyde and Ethyl Acetate. H. Lowery, H. C. Poole and C. Isherwood. *Phil. Mag.* 14. *pp.* 743–745, *Nov.*, 1932.—The refractive index of gaseous acetaldehyde in relation to the density of the substance is found to be 1·0007879 for λ5461, while the dispersion over the range λ4358–λ6708 is represented by the Sellmeier expression $(\mu - 1)_d = 7\cdot4653 \times 10^{27}/(9779\cdot3 \times 10^{27} - \nu^2)$, ν being the frequency of the incident light. The refractive indices of gaseous ethyl acetate for λ5461 and λ5893 (N.T.P. conditions) are found to be 1·001408 and 1·001399 respectively, both results being in agreement with previous work of Mascart. AUTHORS.

586. Dispersion of Gases and Vapours and Representation by the Dispersion Theory. Part III. Dispersion of Oxygen between 6000 Å. and 1920 Å. R. Ladenburg and G. Wolfsohn. *Zeits. f. Physik*, 79. 1–2. *pp.* 42–61, *Nov.* 4, 1932.—A newly constructed interferometer has been used to study the dispersion of oxygen, and the dispersion data can be represented satisfactorily by a formula consisting of three parts. Values of the constants are $\lambda_1 = 1899$ Å.; $f_1 = 4\cdot0 \times 10^{-5}$; $\lambda_2 = 1468$ Å.; $f_2 = 0\cdot20$; $\lambda_3 = 544$ Å.; $f_3 = 5\cdot93$. The significance of these constants is discussed. [See also Abstract 853 (1931).] W. R. A.

587. Mechanical Engineering Applied to the Making of Lenses. W. Taylor. *Engineer*, 154. *pp.* 450–452, *Nov.* 4, 1932.—The engineering principles underlying the design of lens systems and the manufacture of optical glass are briefly outlined. The optimum conditions for efficient sawing, grinding and polishing of glass as applied to the mass production of first-grade lenses are discussed, including the application of the carborundum wheel for roughing purposes, the most efficient relation between size of tool and size of glass disc, the testing of the hardness of pitch used in mounting lenses and an automatic feed for maintaining the supply of rouge and water at the most efficient rate. W. D. W.

See also Abstracts 440, 649, 679, 718.

SPECTROSCOPY.

588. Wave-Lengths and Zeeman Effects in Lanthanum Spectra. W. F. Meggers. *Bureau of Standards, J. of Research*, 9. *pp.* 239–268, *Aug.*, 1932.—More than 1500 wave-lengths were measured in the arc and spark spectra of lanthanum relative to iron standards, extending from λ2142·81 to λ10,954·6. Data on the furnace-spectra of 695 lanthanum lines from λ2798 to λ8346 due to King and Carter are quoted. The Zeeman effects were measured for 476 lines from λ2791 to λ7483, and are tabulated. Comparison of the behaviour of the lines results in 700 being ascribed to the LaI spectrum, 800 to the LaII spectrum and 10 to the LaIII spectrum. These allow of chemical identification of the element. A new infra-red sequence of LaO bands is reported. A. C. M.

589. Interferometer Measurements in the Extreme Ultra-Violet Region of Copper. J. C. McLennan and (Miss) F. M. Quinlan. *Phil. Mag.* 14. *pp.* 823–829, *Nov.*, 1932.—The wave-lengths of 9 lines in the spectrum of copper lying between 1980 Å. and 2090 Å., and also of 9 lines between 2100 Å. and 2280 Å. which were not observed in a previous research by the authors, have been measured by an interference method.

The lines had all been previously noted, and the results of all observers are collected together. J. H. A.

590. Spectra of H.F. Discharges. Part I. Comparison of Damped and Undamped Electrodeless Excitation. J. K. Robertson. *Phil. Mag.* 14. *pp.* 795–806, *Nov.*, 1932.—A comparison is made of the spectra of h.f. discharges in Hg and Cd vapours, obtained with damped waves (D.W. excitation) and with continuous waves (C.W. excitation). At low pressures, D.W. discharges, with spark length of the order of 1 cm, bring out spark and higher level arc lines better than C.W. At higher pressures, C.W. discharges are more effective in bringing out the higher series members. At higher pressures, C.W. discharges are excellent sources of bands, such as that of Hg with head at λ2345Å., and also of regions of continuous spectra, which latter may be photographed with very short exposures. In Cd vapour, in disagreement with the work of Winans [see Abstract 2177 (1929)], a diffuse narrow continuous region, with centre about λ2212 Å., was observed at low pressure with D.W. excitation. In Cd also a broadened self-reversal was found which is considered to be an example of a transition from atomic to molecular absorption. A group of *pp′* lines in Cd was observed under conditions which suggest the possibility of recombination following double ionisation as the mode whereby two electrons are on excited orbits. A. W.

591. Excitation and Emission of Light in the Hydrogen Spark at High Pressures. W. Finkelnburg. *Phys. Zeits.* 33. *pp.* 888–889, *Nov.* 15, 1932.—The spectrum of the spark discharge in hydrogen at 30 atmospheres pressure is investigated, the current density being of the order $3 \cdot 6 \times 10^6$ amperes/cm.^{2}. The spectrum consists of the Balmer lines broadened to such a large extent that an almost completely continuous spectrum results. It is shown that the disturbing secondary effects arising from the high current density and the high pressure in the source are together sufficient to explain the observed continuum without making any special assumption about the primary emission processes. Full details of the investigation are to follow in another paper. J. E. K.

592. Ultra-Violet Spark Spectrum of Rubidium. J. Janin. *Comptes Rendus*, 195. *pp.* 1010–1012, *Nov.* 28, 1932.—By a modification of the discharge method without electrodes [see Abstract 866 (1925)] variations of intensity and aspect have been observed whereby, provisionally, the majority of rays have been connected with the successive degrees of ionisation of the rubidium atom. A table is given of these data. H. H. Ho.

593. Schumann Lines of Copper, Silver and Gold. L. & E. Bloch and J. Farineau. *J. de Physique et le Radium*, 3. *pp.* 437–451, *Oct.*, 1932.—The Schumann line spectra of the three metals were obtained in a vacuum by means of a tangent grating apparatus resembling that of Edlén and Ericson. A very large number of new lines are recorded for copper between 1377 and 385 Å., for silver between 1321 and 260 Å., and for gold between 1341 and 296 Å. E. E. F. d'A.

594. Change of Wave-Length and Intensity of Iron, Nickel and Titanium Lines by Disruptive Discharge. H. Nagaoka, T. Futagami and I. Machida. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers, No.* 394. *pp.* 169–184, *Nov.*, 1932. *In English.*—The shifts of these lines can be divided into several types. They are characteristic of different spectral series, and caused by various physical agencies accompanying the discharge—the field, great pressure, high temperature and collisions of electrons, ions and molecules in the vapour. The broadening, reversals, displacements and other characteristics of the lines may be of some use in elucidating star spectra. F. S.

595. Absorption of Radiation Originating from a Beam of Electrons in Helium. L. R. Maxwell. *Frank. Inst., J.* 214. *pp.* 533–542, *Nov.*, 1932.—An examination is made of the absorption of certain lines with common final states in helium through which a beam of electrons is passing. It is shown that there are in the region close to the electron beam a relatively large number of excited atoms, in both metastable and non-metastable states, capable of producing absorption, and this absorption takes place from both types of states. It is confirmed that all members of the diffuse series are more easily absorbed than are those of the sharp series. A. H.

596. Line Spectrum of the Samarium Ion in Crystals and its Variation with Temperature. S. Freed and J. G. Harwell. *K. Akad. Amsterdam, Proc.* 35. 7. *pp.* 979–994, *Nov.*, 1932. *In English.*—The absorption spectra of Sm^{+++} in the hexagonal crystal $Sm(C_2H_5SO_4)_3, 9\,H_2O$ were taken parallel to the optic axis at 20°, 77° and 169° K. Absorption lines are listed in the region of the spectrum between 4200 Å. and 2200 Å. The experimental method was described earlier [see Abstract 1624 (1932)]. The paper is principally concerned with the various electronic configurations in the basic multiplet, particularly as they result from the interaction of Sm^{+++} and the electric fields of the lattice. These are shown in the absorption spectrum and are identified by the change in the relative intensity of the lines as the temperature changes, more especially by those instances when a line increases in intensity apparently at the expense of a neighbouring line. All lines varying in this way have been studied in terms of energy level diagrams and the details of the spectrograms are described and discussed. R. S. R.

597. Classification of the Spectral Lines of ClV and Cl IV. S. C. Deb. *Acad. Sci. U.P., India, Bull.* 2. *pp.* 43–50, *Aug.*, 1932.—By analogy with the spectra of SiI, PII, SIII and Al I, SiII, PIII respectively the term analysis is determined for Cl IV and ClV. The ionisation potential of Cl IV is determined as 55·17 volts, compared with the earlier value of Bowen of 47·6 volts. For ClV the new value is 69·36 volts, the earlier estimate being 67·2 volts. A. H.

598. Excitation by Collision with Electrons, Ions and Atoms. W. Hanlé and K. Larché. *Phys. Zeits.* 33. *pp.* 884–887, *Nov.* 15, 1932.—Previous experiments made by the authors and others on the intensity, the spectral distribution of intensity, the absolute excitation efficiency and the polarisation of the spectral lines excited by electron collisions in gas discharges are discussed. New experiments on the space distribution of the intensity of the lines excited by electron impact in Hg, He, Ne and A are described. No considerable variations of the intensity with the angle of the exciting electron beam are found; this is also the case for a large range of electron velocities in which considerable changes of polarisation may take place. Experiments on the excitation of lines by positive ion impacts are described. The excitation function of the red neon lines increases continuously with the velocity of the exciting neon ions from 100 to 1200 volts; the excitation potential is probably between 20 and 50 volts. The excitation potential of mercury by mercury ions lies as low as 15 volts. The excitation of mercury shows that there are many complicated factors entering into the process of excitation by ionic collisions, one of the most important being excitation by collisions of the second kind which may occur with an unusually large efficiency. J. E. K.

599. Analysis of Lanthanum Spectra LaI, LaII and LaIII. H. N. Russell and W. F. Meggers. *Bureau of Standards, J. of Research*, 9. *pp*. 625–668, *Nov*., 1932.—All the available data (wave-length measurements and intensity estimates, temperature classes, Zeeman effects) on lanthanum lines have been correlated and interpreted in an analysis of the successive optical spectra. The total number of lines classified is 540 in the LaI spectrum, 728 in the LaII spectrum and 10 in the LaIII spectrum. Series-forming terms have been identified in each spectrum, and from these the ionisation potentials of 5·59 volts for neutral La atoms, 11·38 volts for La^+ atoms and 19·1 volts for La^{++} atoms have been deduced. Lanthanum is a chemical analogue of scandium and yttrium, but, although the corresponding spectra are strikingly similar, some interesting differences are noted. A doublet-D term (from a *d* electron) represents the lowest energy (normal state) in the third spectrum of each element and another ^2D (from the s^2d configuration) describes the normal state of the neutral atoms in each case. The homologous atoms Sc^+, Y^+, La^+ choose different normal states; $(sd)\ ^3D$, $(s^2)\ ^1S$, $(d^2)\ ^3F$, respectively. In addition, the first two spectra of La exhibit a large number of (odd) middle-set terms ascribed to the binding of an *f* electron. The LaII spectrum is the most completely developed example of a two-electron spectrum which has yet been investigated. All the configuration types, s^2, sp, sd, sf, p^2, pd, pf, d^2, df, f^2, have been identified and almost all of the terms arising from each. The analyses of all three spectra are supported by measurements of Zeeman effects, which are interpreted with the aid of Landé's theory. The splitting factors (*g* values) for many levels show marked departure from the theoretical values, but the "*g*-sum rule" is valid wherever it is tested. AUTHORS.

600. First Spark Spectrum of Tellurium. S. C. Deb and H. B. Mohanti. *Acad. Sci. U.P., India, Bull.* 1. *pp*. 26–32, 1931–1932.—Some 90 lines of the first spark spectrum of tellurium, arising from the electron transitions $6s - 6p$, $6p - 6d$ and $6p - 7s$, are classified. A. H.

601. Hyperfine Structure of the Arc Lines and the Nuclear Moment of Copper. R. Ritschl. *Zeits. f. Physik*, 79. 1–2. *pp*. 1–25, *Nov*. 4, 1932. *From the Reichsanstalt*.—The hyperfine structures of the most important visible and ultra-violet arc lines of copper are measured. As sources of light, an electric oven with low-potential excitation and an argon-filled hollow kathode tube cooled with liquid air are used. High resolution of the lines is obtained by means of Fabry-Perot étalons and a Hilger reflecting echelon grating. Analysis of the structures leads to the value $I = 3/2$ for the nuclear moment of both copper isotopes. The terms $(d^9s^2)^2D_{3/2,\,5/2}$ have isotope displacements of 72×10^{-3} cm.$^{-1}$ and 85×10^{-3} cm.$^{-1}$ respectively. The splitting factors of all investigated terms are determined. J. E. K.

602. Hyperfine Structures in the Antimony Spark Spectrum and the Nuclear Moments of Antimony Isotopes. J. S. Badami. *Zeits. f. Physik*, 79. 3–4. *pp.* 206–223, *Nov.* 14, 1932.—The hyperfine structures of a series of SbII lines excited in a vacuum arc lamp are measured by the use of a Fabry-Perot étalon in conjunction with a Zeiss three-prism apparatus. The structures can be explained by the assumption of a nuclear moment $I = 5/2$ for the more abundant isotope Sb^{121} and a nuclear moment $I = 7/2$ for the isotope Sb^{123}. No isotope displacement effect was observed in the antimony hyperfine structures. The splitting factors of many terms are tabulated and compared with the factors of other elements. With the help of the hyperfine structures the series analysis of SbII lines is extended and corrected. J. E. K.

603. Hyperfine Structures in the Antimony Arc Spectrum SbI. J. S. Badami. *Zeits. f. Physik*, 79. 3–4. *pp.* 224–230, *Nov.* 14, 1932.—The hyperfine structures of some ultra-violet arc lines of Sb are measured by means of Fabry-Perot étalons and a reflecting echelon grating. The structure of the line 3723 can be satisfactorily explained and the interval factors of a few terms can be estimated from the observed structures of other lines. The experimental data of other investigators of the hyperfine structure of SbI lines are discussed. The term separations are compared with the corresponding ones of BiI. J. E. K.

604. Isotope Displacement in Hyperfine Structure. G. Breit. *Phys. Rev.* 42. *pp.* 348–354, *Nov.* 1, 1932.—With Goudsmit's extension of Landé's formula for $(1/r^3)$ it is possible to explain the order of magnitude of the isotope displacements in Hg, Tl, Pb arc and spark spectra on the hypothesis of small changes in nuclear radii. The nuclear radius is supposed to be proportional to the 1/3 power of the atomic weight. The effective nuclear change is supposed to be distributed with a roughly uniform density through the interior of the nucleus. The spectra HgI, HgII, TlI, TlII, PbII are in agreement with the above theory. The larger displacements are due to the addition or removal of a $6s$ or $7s$ electron to the electron configuration. The direction of the shift is in agreement with the supposition that the nuclear radius increases with atomic weight, the heavier isotope having the looser binding for the s and $p_{1/2}$ electrons. In order to explain the shifts of the $6p^2$, $6p7s$, $6p8s$, $d6p$, $6p8p$ configurations of PbI it is supposed that in this case the displacements are due principally to changes in the penetration to the nucleus of the $6s^2$ subgroup. These changes are presumably caused by differences in screening of the two $6s$ electrons from the nucleus as the valence electron is excited from the $6p$ state to the ionisation limit. AUTHOR.

605. Lifetime of the Metastable $^3P_2$ Neon Atom. E. Matuyama. *Phys. Rev.* 42. *pp.* 373–378, *Nov.* 1, 1932.—To measure the lifetime of the metastable $^3P_2$ neon atom, the light from a Plücker tube was passed through the absorption tube which contained neon gas at various pressures ranging between 5·2 and 0·25 mm. Hg. The gas was excited by external electrodes connected to the secondary coil of a h.f. oscillator. By adopting the method of the rotating disc the percentage of absorption of the line $^3P_2 - {}^3D_3$ at various stages after the interruption of the excitation of the gas in the absorption tube was measured. The result obtained was that the life of the $^3P_2$ neon atom at a pressure of 5·2 mm. Hg is about 0·005 sec., which is very near that already reported by Dorgelo, but several times longer than that obtained by Meissner and Graffunder. The effects of impurity and of temperature were also investigated. AUTHOR.

606. Duration of Metastable States of Neon. J. M. Anderson. *Canad. J. of Research,* 7. *pp.* 434–443, *Oct.,* 1932.—The rate of decay of absorption of six neon lines, 6402, 6334, 6266, 6163, 6143 and 5945 Å., has been measured for a series of pressures at room-temperature and at the temperature of liquid air. Curves showing the variation of half-life with pressure have been plotted for each line at both temperatures. It is found that the function $\log (I/I_0) = (D_1 - D_2)/\gamma$ is exponential in the time, and that the rate of decay is markedly different at the same pressure and temperature for different lines ending in the same metastable state. [See Abstract 3330 (1931).] AUTHOR.

607. Band Spectrum of Chromium Oxide. C. Ghosh. *Zeits. f. Physik,* 78. 7–8. *pp.* 521–526, *Oct.* 12, 1932.—Band spectrum was excited by a carbon arc in the lower electrode of which either the metal or anhydrous Cr_2Cl_6 was placed. The region 7100 to 4800 Å. was investigated and a new expression by the oscillation spectrum is given. The system is ascribed to a transition between two triplet systems. A heat of dissociation of 3·78 volts is given for the lower state. F. S.

608. Absorption Spectrum of Highly Compressed Oxygen. W. Finkelnburg and W. Steiner. *Zeits. f. Physik,* 79. 1–2. *pp.* 69–88, *Nov.* 4, 1932.—The effect of pressure on the absorption spectrum of oxygen has been investigated using an apparatus for pressures up to 1000 atmospheres. Diffuse triplet bands which increase in intensity as the square of the pressure were found between 2900 and 2300 Å. The origin and significance of these bands is discussed, together with the possibility of their being due to the O_4 molecule. F. S.

609. Photometric Investigation of the Strongest Emission Band of Fluorine. J. Aars. *Zeits. f. Physik,* 79. 1–2. *pp.* 122–138, *Nov.* 4, 1932.—The two emission bands, 17439·5 and 16378·8 cm.$^{-1}$, of F have been photographed with a concave grating and photometered. The ratio of the intensity alteration theoretically expected in the bands was not found, and an explanation of this due to J. Franck is given. The vibration numbers of a third band, 18548·4 cm.$^{-1}$, are given. J. E.

610. Rotational-Vibrational Spectrum of Water Vapour. R. Mecke and W. Baumann. *Phys. Zeits.* 33. *pp.* 833–835, *Nov.* 1, 1932.—The bands at 7227, 7957, 8227, 9060 and 9420 Å. for water vapour are discussed from the point of view of the unsymmetrical rotator. Values for band constants and the moments of inertia are tabulated; the oxygen angle lies between 103° and 106°, and the atomic separations are O—H = 0·965, and H—H = $1\cdot526 \times 10^{-8}$ cm. W. R. A.

611. Infra-Red Absorption of Carbon Tetrachloride. C. Schaefer and R. Kern. *Zeits. f. Physik,* 78. 9–10. *pp.* 609–629, *Oct.* 19, 1932.—The infra-red absorption of CCl_4 was measured from a wave-length of 1μ to 22μ. All the 38 bands discovered could be explained as combinations of the four fundamental frequencies found in the Raman effect. The splitting of the fourth fundamental frequency into two frequencies was confirmed by means of absorption measurements. Moreover, the ratio of the intensities of the two active fundamental oscillations is in accordance with the principle of correspondence. E. E. F. d'A.

612. Infra-Red and Raman Bands of Carbon Dioxide, Carbon Oxysulphide and Carbon Disulphide. A. B. D. Cassie and C. R. Bailey. *Zeits. f. Physik,* 79. 1–2. *pp.* 35–41, *Nov.* 4, 1932.—Fermi has assumed a resonance between the first harmonic of the transverse oscillation and the fundamental of the symmetrical oscillation of carbon dioxide and carbon disulphide; this has been extended to the first harmonic of the symmetrical oscillation. Double doublet separations calculated from this theory are not in agreement with experimental data. W. R. A.

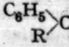
613. Molecular Absorption by Mixed Halogen Molecules in Vacuum-Ultra-Violet. Part II. H. Cordes and H. Sponer. *Zeits. f. Physik,* 79. 3–4. *pp.* 170–185, *Nov.* 14, 1932.—The ultra-violet absorption spectra of the mixed vapours of iodine and chlorine, iodine and bromine, and bromine and chlorine are investigated in continuation of previous work [see Abstract 119 (1931)]. The continuous absorption spectra are associated with the ultra-violet and visible absorption spectra. J. S. G. T.

614. Absorption Spectrum of Sulphur Dioxide. A. K. Dutta. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 88–91, 1931–1932.—An examination is made of the absorption spectrum of SO_2 and a vibrational analysis is attempted. The frequency difference of 1152 cm.$^{-1}$ found from the Raman spectrum appears also in this analysis. Neither the data nor the analysis agree with those of Watson and Parker. [See Abstract 3449 (1931).] A. H.

615. Absorption Spectrum of Calcium Chloride Vapour. S. C. Deb and B. Mukerjee. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 110–115, 1931–1932.—Studying the absorption spectra of polyatomic molecules in the light of recent developments, it is concluded that in the case of molecules whose metallic constituent possesses one or more metastable levels, there will be a banded absorption as well as a continuous absorption, whilst where the metallic constituent possesses no metastable level there will be only continuous absorption. $CaCl_2$ is heated to temperatures between 900° and 1300° C. in an atmosphere of nitrogen and its absorption studied. Two sets of bands (beginning at $\lambda 3917$ and $\lambda 2850$ respectively) are observed, also a continuum commencing at $\lambda 2640$. It is noted that the separation of the two systems ($\Delta\nu = 10{,}000$ cm^{-1}) is of the same order of magnitude as the distance of the metastable state of Ca^+ from its normal state (13,650 cm^{-1}). $SrCl_2$, $BaCl_2$, $CaBr_2$ and $SrBr_2$ exhibit similar behaviour. A. H.

616. Ultra-Violet Absorption Spectrum of Azoxybenzol. E. Müller and E. Hory. *Zeits. f. phys. Chem.* 162. *Abt. A.* 4–5. *pp.* 281–285, *Nov.,* 1932.—The absorption spectra of azoxybenzol, para-, meta- and ortho-azoxytoluol, ortho-dichlorazoxybenzol and ortho-azoxyanisol, each in the normal and the iso-form, have been measured from about 2200 Å. to 3700 Å. The results are discussed from the point of view of the stereometric constitution of azoxybenzol and its derivatives. It is concluded that there is a cis ⇌ trans isomerism. J. H. A.

617. Absorption Spectrum and Dissociation Constants of Arsenic Acid. P. Goldfinger and H. D. G. v. Schweinitz. *Zeits. f. phys. Chem.* 19. *Abt.B.* 4. *pp.* 219–227, *Sept.,* 1932.—From titration curves with different indicators the first dissociation constant of arsenic acid is fixed at 4×10^{-10} (possible error-limits, 2×10^{-10} and 8×10^{-10}). By means of spectroscopic determination of the ionic concentrations for varying alkali content, the second dissociation constant is evaluated as $3\cdot10^{-14}$ (possible error-limits, $1\cdot10^{-14}$ and $6\cdot10^{-14}$). From these two constants follows the order of autoxidation of arsenic acid to the ion $HAsO_3''$ as investigated by Reinders and Vles. The long-wave limit of continuous absorption in 1 mol. solution is found at 2680 Å. for the simply charged ion H_2AsO_3' and at 2800 Å. for the doubly charged H_2AsO_3''. [See also Abstract 4674 (1932).] H. H. Ho.

618. Colour and Structure of Oximes and Semi-Carbazones. (Mme) Ramart-Lucas and (Mme) M. Grumez. *Comptes Rendus*, 195. *pp.* 959–962, *Nov.* 21, 1932.—(i) The ultra-violet absorption of α-methylstyrolene shows a striking resemblance to that of a mono-alkylacetophenone-oxime, which suggests that the oxime of the compound $R.CH_2.CO.C_6H_5$ contains the  $\genfrac{}{}{0pt}{}{C_6H_5}{R}\!>\!C=$ group. This is possible in two ways. (ii) The absorption of the tri-alkylacetophenone-oximes is similar to that of phenyl ethylene oxide. The ultra-violet absorption spectra of the oximes and semi-carbazones thus indicate that not only can these substances exist in two stereochemical forms, but also in two isomeric forms in which the functional group differs. C. B. A.

619. CH Band 3143 Å. T. Heimer. *Zeits. f. Physik*, 78. 11–12. *pp.* 771–780, *Oct.* 28, 1932.—Photographs of the 3143 Å. CH band have been made using a concave grating with a dispersion of 0·95 Å./mm. The source of light was a vacuum arc between two carbon electrodes, the hydrogen pressure was about 50 mm. Hg and the exposure time about 4 hours. The wave-lengths of the lines of the P, Q, and R branches are given. Besides the 0,0 band a new band, a 1,1 band, has been found and is discussed. An approximate value for the energy of dissociation is given. W. R. A.

620. Oscillation and Rotation of the Ammonia Molecule. E. Fermi. *Accad. Lincei, Atti*, 16. *pp.* 179–185, *Sept.*, 1932. *N. Cimento*, 9. *pp.* 277–283, *Nov.*, 1932.—The ammonia molecule, NH_3, has the configuration of a regular triangular pyramid, the principal vertex being occupied by the nitrogen atom, while the hydrogen atoms occupy the three basic corners. The molecule has four fundamental frequencies, two simple and two doubly degenerate. The nitrogen atom has two positions of equilibrium, one on each side of the hydrogen triangle. The frequency with which the atom passes the potential barrier between the two positions determines the separation of the two levels. In fact, all the lines due to rotation and oscillation are double. The author calculates the distance of the components, and shows a close agreement between theory and experiment. The height of the pyramid appears to be $0\cdot32 \times 10^{-8}$ cm. E. E. F. d'A.

621. Bands Due to the Hydrogen Molecule: the $2p^3\Pi$ Bands of Hydrogen. I. Sandeman. *Roy. Soc., Proc.* 138. *pp.* 395–411, *Nov.* 1, 1932.—It is suggested that the hydrogen bands ending on the $2p^3\Pi$ level recently described by Richardson and Davidson [see Abstract 3440 (1931)] are unsatisfactory in that the combination differences are not of the order of accuracy which might be expected from the measurements, and that the upper states are too irregular. These weak points are eliminated if the data are rearranged so that most of the strong lines of Richardson and

Davidson's $3d^3\Pi \rightarrow 2p^3\Pi$ and $3d^3\Delta \rightarrow 2p^3\Pi$ bands are brought into one single strong band system which it is believed is $3d^3\Delta_{a,b} \rightarrow 2p^3\Pi$. Higher rotational and vibrational levels are added. A. H.

622. Absorption Spectrum of Iodine Bromide. W. G. Brown. *Phys. Rev.* 42. *pp.* 355–363, *Nov.* 1, 1932.—It is shown by means of a vibrational analysis that the absorption spectrum of iodine bromide is analogous to that of iodine chloride and that an interpretation similar to that recently proposed by the writer and Gibson for ICl [see Abstract 4282 (1932)] is applicable. The infra-red bands of IBr discovered by Badger and Yost are classified as a $^3\Pi_1 \leftarrow {}^1\Sigma$ transition. The $^3\Pi_{0+} \leftarrow {}^1\Sigma$ system is observed as a faint set of bands in the red, not hitherto reported, which exhibit the same type of predissociation as the corresponding bands of ICl. Transitions to a state which originates at the maximum of the $^3\Pi_{0+}$ state and which dissociates to yield normal iodine and excited bromine atoms are observed as a strong system of partially diffuse bands. Cordes' assignment of these bands to two systems [see Abstract 2410 (1932)] is not confirmed. In the present work the vibrational quantum numbering for each system is deduced from measurements of the isotope effect due to bromine. The heat of dissociation of IBr is $1 \cdot 808 \pm 0 \cdot 001$ volts. For the four molecules I_2, IBr, ICl, and Br_2 it is shown that the separation of the $^3\Pi_{0+}$ and $^3\Pi_1$ states is roughly equal to two-thirds of the mean ^2P multiplet widths of the constituent atoms. The total $^3\Pi$ widths are then probably greater and the $^3\Pi_2$ state somewhat lower than has been supposed. AUTHOR.

623. Interpretation of the Rotational Structure of the CO_2 Emission Bands. R. S. Mulliken. *Phys. Rev.* 42. *pp.* 364–372, *Nov.* 1, 1932.—Schmid's analysis [see Abstract 5000 (1932)] of the rotational structure of a number of the ultra-violet CO_2 emission bands is discussed, and it is pointed out that in spite of uncertainties, some definite conclusions can be drawn, notably that the molecule in equilibrium is nearly linear, or probably strictly linear, in both initial and final states, that B′ is nearly equal to B″, and that the values of both are approximately known (cf. Schmid). It is also shown that the bands are most probably of the type $^1\Pi \rightarrow {}^1\Pi$, but possibly $^1\Sigma \rightarrow {}^1\Sigma$ or (much less likely) $^2\Sigma \rightarrow {}^2\Sigma$ or some other type. If $^2\Sigma \rightarrow {}^2\Sigma$ the emitter must be CO_2^+, otherwise CO_2. It is proposed to designate by κ the quantum number corresponding to the angular momentum of rotation of the carbon atom relative to the O atoms around the O-C-O axis. It is pointed out that in electronic bands, one expects predominantly $\Delta\kappa = 0$. This rule is then applied to possible interpretations of the band structures. Some suggestions are also made concerning the vibrational analysis. Evidence from the values of B and ν_1 is stated, which supports Smyth's interpretation of the *a* and *c* series as ν_1' progressions. It is suggested that the isolated bands λλ2896, 2883 may be the (0,0) band of a $^2\Pi \rightarrow {}^2\Pi$ transition of CO_2^+ with B′ and B″ almost equal. AUTHOR.

624. Rotational Analysis of Ultra-Violet Bands of Silicon Monoxide. P. G. Saper. *Phys. Rev.* 42. *pp.* 498–508, *Nov.* 15, 1932.—From measurements on silicon arc spectrograms a rotational analysis has been made of the (0,1), (0,2), (0,3), (0,4) and (1,4) bands of the ultra-violet band system of silicon monoxide (SiO). The bands were found to be due to a $^1\Pi \rightarrow {}^1\Sigma$ transition as was expected by analogy with the fourth positive bands of CO. Among the constants obtained from the analysis are:

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$B_0' = 0\cdot6270$, $r_e' = 1\cdot62 \times 10^{-8}$ cm., $\alpha' = 0\cdot00657$; $B_0'' = 0\cdot7238$, $r_e'' = 1\cdot51 \times 10^{-8}$ cm., $\alpha'' = 0\cdot00494$. A number of perturbations of the Q branch lines were observed. Some conclusions were reached as to the nature of the perturbing levels. From measurements of band heads of this system made by Jevons and the results of the present analysis the following equation was obtained for the band origins: $\nu_0 = 42835\cdot3 + 851\cdot51(v' + 1/2) - 6\cdot143(v' + 1/2)^2 + 0\cdot0437(v' + 1/2)^3 - 1242\cdot03 (v'' + 1/2) + 6\cdot047(v'' + 1/2)^2 - 0\cdot00329(v'' + 1/2)^3$. AUTHOR.

625. Quantum-Mechanical Calculation of the Intensities of Infra-Red Bands. K. Scholz. *Zeits. f. Physik*, 78. 11–12. *pp.* 751–770, *Oct.* 28, 1932.—The theoretical estimation of the intensities of infra-red bands has been worked out, for diatomic molecules, on the basis of the potentials given by Morse [see Abstract 63 (1930)]. It is assumed that there is not a coupling of the vibration and rotation effects but only a superposition. It is also assumed that the molecule has the same potential curve before and after the quantum jump. A further communication, dealing with the calculation of band intensities when the potential curves are different, is intimated. W. R. A.

626. Interpretation of the Ultra-Violet Absorption Bands of Alkali Halides. M. Born. *Zeits. f. Physik*, 79. 1–2. *pp.* 62–68, *Nov.* 4, 1932.—A theory is developed by which it is deduced that the ultra-violet bands of alkali halides arise from a neutralisation of an ion pair in the interior of the crystal. Significant data for fifteen halides are given. W. R. A.

627. Air Afterglow and Active Nitrogen. J. K. Robertson. *Canad. J. of Research*, 7. *pp.* 444–450, *Oct.*, 1932.—In view of the lack of published photographs of the spectrum of the air afterglow, and of useful information which might be obtained relating to aurora discharges, the spectrum of this afterglow was photographed in the visible region. Excitation was accomplished by means of external electrodes used in connection with a Hartley oscillating circuit, a method which lends itself to the use of feeble excitations, and one, moreover, which does not seem to have been used hitherto. The spectrograms obtained show a continuous faintly banded region extending from below 4400 to 5000 Å. or beyond, and a pure *continuum* in the yellow and red region with a distribution of intensity roughly corresponding to that shown by the yellow and red first positive nitrogen groups. Evidence is submitted that the part of the afterglow at the yellow-red end of the spectrum is due to nitrogen, not to oxygen, the source to which the continuous spectrum is generally ascribed. In an attempt to obtain further information regarding the nature of the entity emitting the air afterglow, by the addition of mercury vapour to the glowing gas, it was found that the glow was at once destroyed. AUTHOR.

628. Formation of Negative Ions According to Quantum Mechanics. Y. Rocard. *Comptes Rendus*, 195. *pp.* 945–947, *Nov.* 21, 1932.—When an electron is affixed to a molecule, a spectrum known as an electro-affinity spectrum is emitted. It is the object of this paper to attempt a theoretical explanation of this spectrum. It is considered that a perturbation frequency given by $h\nu = \frac{\epsilon - 1}{8\pi n} \cdot \frac{e}{r_0^4} + \frac{1}{2}mv^2$, where ϵ = dielectric constant, n = number of molecules, r_0 = distance of electron from

centre of molecule, and v = velocity of approach of electron, is added to the rotation frequency of the molecule, bringing the spectrum into the visible. The existence of negative ions of He or H in the Heaviside layer accounts on this view for the brilliance of a part of the night sky spectrum.
J. E.

629. Absorption Spectra of Saturated Halides of Multivalent Elements. A. K. Datta and M. N. Saha. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 19–25, 1931–1932.—According to Franck, the heat of dissociation of a molecule may be calculated from the long wave-length limit of the continuous absorption of the molecule. In the case of the hydrogen halides, however, the rule does not hold, possibly because of non-ionic binding. A systematic investigation is commenced of the absorption spectra of polyatomic compounds and results are put forward for CCl_4, $SiCl_4$, $SnCl_4$ and $TiCl_4$. In every case continuous absorption is observed but no close agreement is obtained between the values of the heat of dissociation calculated from photodissociation according to Franck's idea, and those experimentally obtained. A. H.

630. Absorption Spectra of Saturated Halides. S. C. Deb. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 92–99, 1931–1932.—The absorption spectra of the halides of aluminium, magnesium and silicon are studied from spectrograms obtained on a Hilger medium quartz spectrograph. In every case continuous absorption is observed in the ultra-violet. Employing the ideas of Franck the atomic heats of formation are calculated, and it is observed that only in the case of alkali halides is a fit with Franck's theory obtained. A. H.

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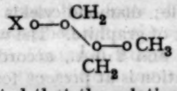
631. Absorption Spectra of Some Alkali Fluorides and Heat of Dissociation of Fluorine. M. S. Desai. *Acad. Sci. U.P., India, Bull.* 1. *pp.* 116–118, 1931–1932.—The absorption spectra of the fluorides of lithium, sodium and potassium vaporised at a temperature of 900–1000° C. in an atmosphere of nitrogen are studied by means of a Hilger medium quartz spectrograph. If L_M and L_{MF} are the heats of vaporisation of the metal (M) and the molecule (MF) respectively, whilst R is the heat of formation of the molecule (obtained from the long wave-length limit of absorption) and Q is the heat of reaction, then the heat of dissociation of fluorine (D_{F_2}) is given by $1/2D_{F_2} = R - (Q + L_M - L_{MF})$. D_{F_2} is determined as 76 ± 2 k.cal. The heat of evaporation of lithium is also determined as 29·4 k.cal. per gramme atom. A. H.

632. Absorption Spectra of Lithium Halides and Latent Heat of Evaporation of Lithium. M. S. Desai. *Acad. Sci. U.P., India, Bull.* 2. *pp.* 33–38, *Aug.*, 1932.—The absorption spectra of the halides of lithium are studied, the anhydrous salts being vaporised in an atmosphere of nitrogen and the spectra registered by a Hilger medium quartz spectrograph. In each case continuous absorption beginning from an ill-defined long wave-length limit is observed. The results are interpreted in the light of Franck's theory of the photodissociation of alkali-halides. The latent heat of evaporation of lithium is determined as $29 \cdot 6 \pm 0 \cdot 6$ k. cal. A. H.

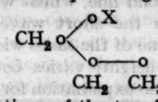
633. Theory of Continuous Absorption of Oxygen at 1450 Å. E. C. G. Stueckelberg. *Phys. Rev.* 42. *pp.* 518–524, *Nov.* 15, 1932.—The continuous absorption of O_2 has lately been measured by Ladenburg, van Voorhis and Boyce [*Phys. Rev.* 40, 1018, 1932]. Their suggested explanation in the term diagram of the molecule is compared to the corresponding matrix elements. AUTHOR.

634. Regularities in the Line Spectra of Solids. R. Tomaschek. *Phys. Zeits.* 33. *pp.* 878–884, *Nov.* 15, 1932.—A discussion of the known facts regarding the line spectra of solid solutions in phosphorescent emission and absorption, particularly those of the rare earths. It is considered that these spectra represent electron jumps on which are superimposed the vibrations of the parent lattice and of the light centre itself. The vibration frequencies deduced from these spectra in the cases of samarium and praseodymium are less than those of the pure lattice given by Raman effect, and the differences are attributed to distortion of the lattice in the phosphors. Diagrams are given showing how the lattice frequencies for the alkali earth oxides and sulphides compare with the frequencies deduced from the phosphorescent spectra of Sa and Pr phosphors. Phosphors are divided into two distinct classes, those like the Cr and uranyl phosphors in which the activator enters the lattice isomorphically without distorting it, and those like the Lenard phosphors in which the activator is lightly attached to the lattice, which it distorts. With the first class is associated short duration emission and a close relation between emission and absorption; with the second class, long duration emission. The influence of lattice type and dimensions is discussed. Figures are given showing that similar lattices give similar spectra, *e.g.*, the NaCl type giving doublets. The shift of the null line to the blue with increasing lattice constant is attributed to greater distortion, and the shift towards the red in the sulphides as compared with the oxides is connected with the polarisability of the anions. While the electron terms cannot be given for rare earth phosphors on account of lack of knowledge, the Cr phosphors investigated by Deutschbein [see Abstracts 4958–4960 (1932)] show lines accounted for by transitions within the same electron configuration with change of spin. Assuming the same sort of transitions to take place in the rare earths (phosphors giving sharp lines), the spectra of Sa, Pr, Nd and Er have been arranged in term series, and the results are given in diagrams. J. E.

635. Raman Effect and Free Rotation about a Bond. K. W. F. Kohlrausch. *Zeits. f. phys. Chem.* 18. *Abt.B.* 1. *pp.* 61–72, *July*, 1932.—Comparison of the Raman spectra of related substances containing alkyl groups and halogen atoms allows the internal valence frequencies of the alkyl groups (R) to be distinguished from the frequencies due to the R-X bond. The latter are related in such a way as to suggest that the C-X bond decreases in strength as the number of H atoms attached to the C increases, and that it increases with the number of groups to which the C atom in question can be considered to be bound by pseudo-bonds (*Kantenbindungen*). The valence-frequency R-X is double in those cases in which it is possible for the molecule configuration to be altered through free rotation about a linkage (*freie Drehbarkeit*). For example, in *n*-propyl halides, rotation around the —CH_2—CH_2— linkage can give rise to any form between the open form and the quasi-ring form; *viz*:—



and



It is expected that the relative concentrations of the two forms would be affected by temperature; a preliminary result with dichlorethane shows that the ratio of the intensity of the lines due to the two forms alters with temperature. A. C. M.

636. Zeeman Effect of Perturbed Terms in the CO Ångstrom Bands. W. W. Watson. *Phys. Rev.* 42. *pp.* 509–517, *Nov.* 15, 1932.—The Zeeman effect of the perturbed lines in the CO Ångstrom bands $({}^1\Sigma \rightarrow {}^1\Pi)$ is described. The perturbations are multiple, occur in the $^1\Pi$ state, and contain excess, much-displaced lines. New lines extending the "resonance" curves of Rosenthal and Jenkins are found. The perturbed lines show large, irregular Zeeman patterns, whereas the neighbouring band lines with these intermediate and high J values are apparently insensitive to the magnetic field. Always the greater the displacement of the perturbed line, the larger its Zeeman effect. The patterns differ at each perturbation point; they are either broad, asymmetrical doublets; very broad, uniform blocks; sharp, narrow doublets; or just a shift, increasing the amount of the perturbation. An explanation is offered, assuming the perturbing state to be case a $^3\Pi$. AUTHOR.

637. Raman Effect in Perchlorates. Z. Ollano. *Zeits. f. Physik,* 77. 11–12. *pp.* 818–822, *Sept.* 3, 1932.—The Raman frequencies of the ClO_4^- ion are found to be 118, 936, 627 and 461 cm.$^{-1}$ by investigation of solutions of sodium, potassium and ammonium perchlorates, and of perchloric acid. In concentrated aqueous solutions of perchloric acid the frequency 3550 cm.$^{-1}$, and in weak solutions 3580 cm.$^{-1}$, and in perchlorate solutions 3590 cm.$^{-1}$ is attributed to hydroxonium ions $(H_3O)^+$. A. C. M.

See also Abstracts 537, 560, 566, 582.

X-RAYS.

638. X-Ray Emission Spectrum and Chemical Combination. Part I. Fluorescence Excitation of the K$\alpha_1\alpha_2$ Doublet of Sulphur. O. Lundquist. *Zeits. f. Physik,* 77. 11–12. *pp.* 778–787, *Sept.* 3, 1932.—The author describes his apparatus for studying the X-ray emission of substances excited by primary X-rays. This method of excitation minimises the heating-up of the specimen, so that chemical compounds are more easily investigated. The element sulphur and the compounds Cr_2S_3, CuS, ZnS, Ag_2S, Na_2SO_3, $CaSO_3$, $CuSO_3$, $BaSO_3$, Na_2SO_4, $CaSO_4$, $NiSO_4$ and $CuSO_4$ were studied and the wave-lengths of the lines of the K$\alpha_1\alpha_2$ doublet are given for each substance. For the sulphides the doublet is displaced 0·27 X.U. towards the longer waves, and for the sulphites 2·09, for the sulphates 2·75 X.U. towards the short waves, taking the doublet of the uncombined element as reference. W. S. S.

639. Influence of Lattice Combination on the Kα-Line of Carbon. M. Renninger. *Zeits. f. Physik,* 78. 7–8. *pp.* 510–520, *Oct.* 12, 1932.—The Kα-line (44·6 Å.) of carbon is in all cases steeper on the long wave-length side than on the other. With graphite the line is unsymmetrical, suggesting the existence of a shorter wave-length satellite, and the maximum is displaced by about 0·4 Å. towards the longer wave-lengths, as compared with the diamond line, whilst with carborundum the line is narrower and very steep on the short wave-length side; diamond yields an almost symmetrical line of the same width as that of graphite. The width of the lines (at half height) varies between 1·2 and 2·0 Å., according to the intensity, but no explanation for such variation is at present forthcoming; for carborundum the width is about 0·9 Å. H. F. G.

See also Abstracts 436, 442, 444, 570, 714.

HEAT.

CALORIMETRY.

640. Law of Additive Atomic Heats. J. A. Bottema and F. M. Jaeger. *K. Akad. Amsterdam, Proc.* 35. 7. *pp.* 916–930, 1932.—The molecular heat of the intermetallic compound AuSn was found to be smaller than the sum of the atomic heats of its components. Three different modifications of the compound $AuSb_2$ were found to exist, the transition temperatures being about 355° and 405° C. The atomic heat of Sb was determined, and it appeared that this element has a transformation point at about 413° C., the atomic heat falling from about 6 to 3 cal. per degree at this temperature and thereafter rising rapidly. Comparing the molecular heats of $AuSb_2$ with the sum of the atomic heats of its components, it was found always to be greater, whereas for PtSn and AuSn the contrary is the case. A mixed crystal of 25·56 atomic % Au and 74·44 atomic % Ag was investigated, and it was found that the deviations from the rule of additive atomic heats were for the most part within the range of experimental error. L. G. C.

641. Behaviour of Beryllium after Preliminary Heating above 420° C. F. M. Jaeger and E. Rosenbohm. *K. Akad. Amsterdam, Proc.* 35. 8. *pp.* 1055–1061, 1932.—Be which has been heated above 420° C. exhibits abnormal thermal behaviour, in that on cooling it continues to give out heat for a considerable period, and retains its abnormal thermal properties for times of the order of a year. The effect would be explicable if the thermal conductivity were much decreased by the heat treatment, but experiment shows that this is not the case. Further work is promised. L. G. C.

642. Calorimetric Investigations in the Temperature Region of Liquid Helium. K. Mendelssohn and J. O. Closs. *Zeits. f. phys. Chem.* 19. *Abt.B.* 4. *pp.* 291–298, *Nov.*, 1932.—The atomic heat of copper has been determined between 4·5° and 15° Abs., and of silver between 2° and 20° Abs. An interesting effect was found in the case of copper, on the surface of which it appears that gas is absorbed at very low temperatures, desorption taking place at about 5° Abs. L. G. C.

See also Abstracts 632, 647, 657, 664.

CONDUCTION.

643. Friction, Thermal Conductivity and Diffusion in Gaseous Mixtures. Part XXI. M. Trautz. *Ann. d. Physik*, 15. 1. *pp.* 198–218, *Nov.*, 1932.—An attempt is made to differentiate the value of molecular cross-section as obtained from values of η measurements and those obtained otherwise. The value so obtained is called the mean η-cross-section. The paper opens with a critical survey of the earlier methods for calculating molecular diameters from the gas friction constant and compares the values so obtained with those from the equation of state as put forward by Maxwell, Chapman, and according to the Sutherland model. All gases behave at the critical temperature, according to the evidence of the temperature coefficient of η as Maxwell molecules. Their diameters are Maxwell diameters, and the value of T_k itself is known as the Maxwell point of gaseous friction. The relative molecular diameters were calculated and the results for He, Ne, A, Kr, X are tabulated alongside the measured values. The case of Ne presents the smallest deviation between calculated and measured values. The cube of the Maxwell diameter runs proportional to the van der Waals–van Laar value of b_k in such excellent agreement that it is possible to calculate each of these quantities by means of a universal proportionality constant as also the critical pressure. The Sutherland diameters as calculated from the older types of expression are in the ratio of 0·85 smaller than the Maxwell diameters. From the knowledge of the temperature range and the whole number value of the Maxwell diameter for different substances for which the Maxwell equation is valid, the nature of the critical temperature is evident. It appears as a physically defined temperature point where exclusively, in general and with all states of aggregation of molecules, they behave according to the Maxwell law. S. G. B.

644. Association in Gases under the Effect of Electric Fields. H. Senftleben. *Phys. Zeits.* 33. *pp.* 826–829, *Nov.* 1, 1932.—The paper commences with a short account of results given in a previous paper [see Abstracts 1309 (1931) and 2905 (1932)]. The increase in the thermal conduction of a gas brought about by the application of an electric field is considered. A formula is obtained by thermochemical, and, separately, by thermodynamical considerations, for the increase in heat-content of unit volume of a gas in terms of the electric field-strength applied. The increase in heat-flow under a temperature gradient is proportional to the square of the electrical field-strength. Quotes experimental results in support of the formula, and shows the possibility of deducing the heat of dissociation and the effective cross-section of molecules from measurements of the effect of electric fields on thermal conductivity at various temperatures. G. G. S.

645. Temperature Variation of the Thermal Conductivity of Pyrex Glass. R. W. B. Stephens. *Phil. Mag.* 14. *pp.* 897–914, *Nov.*, 1932. *Supplement.*—The thermal conductivity of pyrex glass has been investigated over the range − 180° to 250° C., and the variation found to satisfy the relation $K = A + b.\log_{10}T$, where A and b are constants of values − 0·00352$_3$ and 0·00245$_4$ respectively, K being expressed in cal. cm.$^{-1}$ sec.$^{-1}$ deg.$^{-1}$, while T is the absolute temperature. The density of the glass was 2·23$_3$ gm. per c.c. at 21° C., and its composition 80·5 % silica, 2 % alumina, 12·5 % boric oxide and 4 % sodium oxide. Previous data by Bridgeman (cylindrical method) and Reulos (plate method) are quoted and discussed. H. H. Ho.

646. Improvements in the Use of the Lees and Chorlton Heat Conductivity Apparatus. C. H. Lees and H. A. Nancarrow. *Phil. Mag.* 14. *pp.* 811–823, *Nov.*, 1932.—The apparatus of Lees and Chorlton was described in 1896, and was intended to be of use for industrial materials. The principle of the method is to place a disc of the material under test between two metal discs, of which the upper one is steam-heated and the lower one is used as a calorimeter, the heat loss from its surface having previously been determined at a series of temperature excesses over the surrounding air. The present paper gives minor constructional improvements and, in the theory, it replaces the assumption of Newton's law for the heat loss by the assumption of the convection law, that heat flow is proportional to the 5/4 power of the temperature excess. J. H. A.

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CONVECTION.

647. Heat Loss from Dewar Flasks. K. S. Cole and R. H. Cole. *Rev. Sci. Instruments*, 3. *pp.* 684–686, *Nov.*, 1932.—Dewar flasks obey Newton's law of cooling when the contents are adequately stirred. From cooling curves the water equivalent has been determined and the heat loss coefficient in cal./hr./° C. difference has been found to be independent of the volume of contents between 50 % and 90 % capacity. For twin calorimetric purposes, flasks may be equalised by variation of the volume of contents as suggested by Hill, but it has been found that the best flasks are quite uniform and require but little compensation. The half-pint flasks used have a heat loss of about 12 cal./hr./° C. difference and water equivalent of about 36 c.c. AUTHORS.

DILATATION.

648. Thermal Expansion of Lead. P. Hidnert and W. T. Sweeney. *Bureau of Standards, J. of Research*, 9. *pp.* 703–709, *Nov.*, 1932.—Measurements have been made on the linear thermal expansion of three samples of cast lead between room-temperature and 300° C. and the results have been correlated with data obtained by other investigators between 1740 and 1931. A curve has been derived which shows the linear thermal expansion of lead between − 253° and + 300° C. The summary gives average coefficients of expansion for various temperature ranges between − 250° and + 300° C. A comparison of the indirect results by Kopp and Matthiessen with the direct data by other observers indicates that lead expands the same in all directions. AUTHORS.

649. Vacuum Apparatus for Measuring Thermal Expansion at Elevated Temperatures, with Measurements on Pt, Au, Mg and Zn. J. B. Austin. *Physics*, 3. *pp.* 240–267, *Nov.*, 1932.—An apparatus for measuring linear thermal expansion between room-temperature and 950° C. *in vacuo* by an interference method has been developed and tested on platinum, gold, magnesium and single-crystal zinc. Although designed primarily for metals which oxidise readily, it seems to give excellent results for all metals in the temperature ranges through which their vapour pressure is low. Under conditions such that a metal has a high vapour pressure the performance is not quite so satisfactory because of the deposition of metallic films on some of the cooler parts of the optical train. The refractive index of fused silica for the helium line λ5877·2 has been calculated for the temperature range 18° to 950° C. A study of the dilatation of single-crystal zinc yields no evidence for the existence of more than one form between 20° and 350° C. AUTHOR.

MELTING AND BOILING POINTS.

650. Liquid Nitrobenzol Near the Melting Point. J. Wellm. *Zeits. f. phys. Chem.* 19. *Abt.B.* 2–3. *pp.* 113–116, *Oct.*, 1932.—Measurements of the density, the viscosity and the dielectric constant in liquid nitrobenzol lend no support to any anomaly in the neighbourhood of the melting point, such as is alleged by Wolfke and Mazur [see Abstracts 2483 (1932) and 423 (1933)]. A. D.

651. Fusion under Pressure. E. Jänecke. *Zeits. f. phys. Chem.* 162. *Abt.A.* 4–5. *pp.* 286–288, *Nov.*, 1932.—In a previous paper [see Abstract 509 (1932)], an interpolation formula was given for the relationship between pressure and melting point. This formula predicted a limiting melting point at very high pressures, in accordance with the theoretical work of van Laar. The latter has now revised his theory, and no longer predicts such a limiting melting point. In consequence, the interpolation formula has no particular advantage over others which represent the observations in the observed range. J. H. A.

See also Abstract 577.

TEMPERATURE, MEASUREMENT OF.

652. Reduction of Platinum Resistance Thermometers to the International Temperature Scale. G. S. Callendar. *Phil. Mag.* 14. *pp.* 729–742, *Nov.*, 1932.—Methods are described which can be employed for the reduction of observations of resistance of a platinum resistance thermometer to gas scale temperature, in order to save time in those reductions and obviate the use of tables. An example is then considered where two platinum thermometers are used to determine an identical temperature, and it is shown that different thermometers can reproduce the international scale of temperature to a remarkable extent even if the quality of the platinum in each is markedly different. It is estimated, from consideration of the possible experimental errors, that the uncertainty of reproduction of a temperature on the international scale from 200° to 500° C., by two independent observers, is ± 1/50° C. At temperatures 550° to 600° C. the uncertainty may be as large as 1/20° C. T. B.

653. Coloured Filter for Optical Pyrometers. I. Peychès. *J. de Physique et le Radium*, 3. *pp.* 487–500, *Nov.*, 1932.—In optical pyrometry an error of 10 Å. in the estimated wave-length implies an error of 4° in the temperature in the region between 1336° K. and 2700° K. Moreover, the spectral interval utilised in the measurements is not perfectly monochromatic. The slit being of finite aperture, it becomes necessary to fix an effective wave-length to insert in the formulæ. The author has paid special attention to the determination of the effective wave-length for a glass filter, Jena F 4512 (6 mm. thick). For temperatures between the melting points of gold and of platinum the effective wave-length of this filter is 6552 Å. ± 2 Å. By utilising this figure it is easy to calibrate other filters. E. E. F. d'A.

654. Use of Triode as Relay in Temperature Regulation. E. Rosenbohm. *K. Akad. Amsterdam, Proc.* 35. 6. *pp.* 876–877, 1932.—In order to get rid of troubles due to the passage of even small currents through a sensitive contact-thermometer, a triode is employed to establish the relay contact, thus making it possible to operate the thermometer with a current of only a few microamperes. The contact-thermometer is connected, in series with a biasing battery, across a 5–10 megohm leak connected between the grid and filament of the triode. When the contacts are open, the grid bias is zero, and sufficient anode current flows through the valve to hold open a relay. When the contact closes, however, the valve receives a negative bias, the anode current falls considerably, and the relay circuit is closed. G. E. B.

655. Modifications of Resistance Thermometer Bridge and of Commutator Selector. Marion Eppley. *Rev. Sci. Instruments*, 3. *pp.* 687–711, *Nov.*, 1932.—The paper describes alterations made to a special form of Wheatstone bridge [see Abstract 70 (1917)] with a view to lessening the effect of contact resistances which might introduce errors when measuring small resistances, and to improving the galvanometer damping by making the bridge resistance nearly constant over its entire range. The selector commutator for use with more than one thermometer is also modified to increase the speed of working. Practical details are given as to temperature control and the avoidance of contact resistances in the thermometer leads. G. G. S.

THERMOCHEMISTRY.

656. Heats of Dilution of Solutions of Strong Electrolytes, and the Association Hypothesis of Nernst. E. Plake. *Zeits. f. phys. Chem.* 162. *Abt.A.* 4–5. *pp.* 257–280, *Nov.*, 1932.—The heats of dilution H of 0·5–0·01M solutions of di-di-, uni-di- and di-uni-valent salts have been determined at 0°, 10° and 20° C. For the first group dissociation is almost complete at 20° C. at concentrations below 0·25M; the variation of H with concentration and the large temperature coefficient are discussed at length. Certain di-uni-valent salts also appear to be completely dissociated, but others, and the uni-di-valent salts, exhibit negative and sometimes very large values of H. The degrees of association and heats of dissociation of these salts have been calculated by Nernst's method. The values of H at different concentrations, calculated on the assumption that the mass action law is applicable to the variation of the association with concentration, are in agreement with the observed values only if equilibria such as $[CaNO_3]^{\cdot} \rightleftharpoons Ca^{\cdot\cdot} + NO_3'$ are postulated. The calculated degrees of association are of the same order as those derived from freezing point and equivalent conductivity measurements. H. F. G.

657. Internal Energy of Gases after Explosion. W. T. David, J. R. Brown and A. H. El Din. *Phil. Mag.* 14. *pp.* 764–777, *Nov.*, 1932.—Bolometric and manometric measurements made during and after the explosion of carbon-monoxide-air and hydrogen-air mixtures in spherical cast-steel vessels of diameters 6 and 17·45 in. show that when mixtures of identical composition are exploded in similar vessels of different sizes, higher pressures are developed in the larger vessel and are not attributable to the lower relative heat loss occurring in this vessel. Combustion is more advanced at the moment of development of maximum pressure in the larger vessel, and even therein is probably not complete. The explosion method as usually practised cannot be relied upon to provide accurate information relating to the specific heats of gases at high temperatures, even when measured heat losses are taken into account. It is shown that calculated specific heats of the triatomic products of combustion in the authors' experiments are considerably greater when deduced from results obtained with the smaller explosion vessel. J. S. G. T.

658. Heats and Nature of Combination of Organic Molecular Compounds. G. Briegleb and T. Schachowskoy. *Zeits. f. phys. Chem.* 19. *Abt.B.* 4. *pp.* 255–277, *Nov.*, 1932.—The heats of dissociation, U (given in brackets), of molecular compounds between *s*-trinitrobenzene and benzene ($< 0{\cdot}5$), diphenyl (1·4), naphthalene (3·4), phenanthrene (4·0) and anthracene (4·4) in CCl_4 solution, and of naphthalene and anthracene in Et_2O and C_6H_6 have been deduced from their absorption spectra by the formula $U = 4{\cdot}56T_1T_2\log(qc_1^2/c_2^2)/(T_1-T_2)$, where q is the ratio of extinction coefficients at temperatures T_1, T_2 and c_1, c_2 the concentrations of the solutions. For comparative results the same solvent must be used, and one devoid of affinity for either constituent of the compound concerned. Comparison with the heats of dissociation of similar compounds with $C_6H_5NO_2$ and $C_6H_4(NO_2)_2$ shows that combination is due to the total field of all NO_2 groups present. The hydrocarbon and nitro-compound molecules are so arranged that the maximum moment induced in the hydrocarbon is in the direction of maximum polarisability deduced from the Kerr constant, the heat of dissociation decreasing in the same order as the polarisability. The moment induced in a benzene nucleus attached through a $-C-C-$ group is insufficient to give a compound with s-$C_6H_3(NO_2)$; it must be attached through a $-C{=}C-$ group. [See Abstract 3373 (1932).] C. A. S.

659. Studies in Coordination. Part IV. Some Fluorides and Chlorides and their Complex Ions. F. J. Garrick. *Phil. Mag.* 14. *pp.* 914–937, *Nov.*, 1932. *Supplement.*—Previous papers [see Abstract 2503 (1931)] dealt with coordination compounds in which a central ion combines with neutral molecules; the energies of coordination for fluoride and chloride molecules (and complex ions) are now calculated in terms of a heteropolar model. For molecules, the same quantity is estimated thermochemically. The energies of hydration of complex ions and the lattice energies of complex salts are considered, and from these and the energies of coordination conclusions are obtained with respect to the stabilities of various known and hypothetical complex ions. H. H. Ho.

660. Thermal Decomposition of Methane by a Carbon Filament. H. H. Storch. *Am. Chem. Soc., J.* 54. *pp.* 4188–4198, *Nov.*, 1932.—The pyrolysis of methane by a hot carbon filament in a bulb cooled by liquid nitrogen, oxygen, solid CO_2 or ice is studied. The primary products are ethane and hydrogen without tarry matter; but, as the hydrogen pressure increases, secondary reactions occur. With an initial pressure of methane of 1 to about 8 cm., the reaction is of the first order with a heat of activation of about 77,000 cal. The apparent increase of the order of reaction at higher pressures is attributed to changes of temperature gradient close to the filament. The filaments were made from cotton peptised by zinc chloride, washed and carbonised. A. S. C. L.

See also Abstracts **441, 607, 619, 630, 631, 644, 666, 667, 668, 712, 729, 752.**

THERMODYNAMICS.

661. Polyphase Equilibria in Systems which are Separated by Membranes. R. Eisenschitz. *Zeits. f. phys. Chem.* 162. *Abt.A.* 3. *pp.* 216–222, *Nov.*, 1932.—From the general condition of thermodynamic equilibrium, the number of degrees of freedom has been calculated for a system in which several phases are in equilibrium but separated by semipermeable or impermeable membranes. H. H. Ho.

662. Thermodynamic Properties of Fused Salt Solutions. E. J. Salstrom. *Am. Chem. Soc., J.* 54. *pp.* 4252–4256, *Nov.*, 1932.—A reversible bromine gas electrode has been applied to the study of the thermodynamic properties of fused solutions of rubidium bromide in silver bromide. E.M.F. values are given for the cell, Ag(*s*), AgBr(l), RbBr(l), $Br_2(g)$, at 1·000, 0·747, 0·596, 0·467 and 0·352 mole fractions of silver bromide. The density of a half mole fraction solution of rubidium bromide in silver bromide has been measured between the temperatures 514° and 624°. Calculations of the free energy of formation, free energy of dilution, heat of formation, entropy changes, activity and activity coefficients are given at the temperatures 500°, 550° and 600°. AUTHOR.

663. Thermodynamic Properties of Liquid Solutions of Silver Bromide with Alkali Bromides. J. H. Hildebrand and E. J. Salstrom. *Am. Chem. Soc., J.* 54. *pp.* 4257–4261, *Nov.*, 1932.—Previously published data for the difference between the observed and ideal partial molar free energies of solutions of AgBr in Li, Na, K and Rb bromides conform to the equation $\overline{F}_1 - \overline{F}_1^i = bN_2^2$; the constant *b* is independent of temperature and has the values 1880, 1050, — 1480 and — 2580 cal. respectively. An equation of similar form is obtained by statistical treatment based on the assumption that the presence of a large alkali ion permits tightening of the bond between the Ag and Br, whereas a small alkali ion has the reverse influence. H. F. G.

664. Heat Capacities, Entropies and Free Energies of Seven Organic Compounds containing Nitrogen. H. M. Huffman and H. Borsook. *Am. Chem. Soc., J.* 54. *pp.* 4297–4301, *Nov.*, 1932.—Results are given of measurements of the heat capacities of *d*-alanine, *l*-asparagine, *l*-asparagine hydrate, *l*-aspartic acid, *d*-glutamic acid, creatine and creatinine over the temperature range 90° to 298° K. From these data the entropies are calculated, the values obtained for succinic acid, aspartic acid and asparagine showing that replacement of a hydrogen atom by a hydroxyl or amino group involves no change in the entropy; lengthening of the carbon atom chain from glycine to *d*-alanine gives an increase of 5·5 E.U. and that from aspartic to glutamic acid one of 4·2 E.U. The free energies of the compounds are also calculated, the accuracy of the results being limited largely by that of the combustion data. T. H. P.

665. Exact Thermodynamics of Membrane Equilibria. F. G. Donnan and E. A. Guggenheim. *Zeits. f. phys. Chem.* 162. *Abt.A.* 4–5. *pp.* 346–360, *Nov.*, 1932.—By the expression membrane equilibrium is indicated the equilibrium existing between two phases at the same temperature when these are separated by a membrane permeable to some, but not all, molecules or ions. The general thermodynamic principles governing such equilibria for systems containing no electrically-charged particles were established by Gibbs, and Donnan showed how thermodynamic considerations may be applied to systems with charged ions (*Zeits. f. Elektrochem.* 17. p. 572, 1911). To deduce relationships between directly measurable quantities from the general thermodynamic principles, various approximations, *e.g.*, that the solutions are very dilute or incompressible or miscible without change in volume, have been made. Using the analytical methods of Gibbs, the authors deduce exact equations, of general and simple type for the membrane equilibria of electrolytes and non-electrolytes, both in ideal and in non-ideal solution, without introducing inaccurate approximations. The relations between the formulæ obtained and the inexact ones commonly used are discussed.

T. H. P.

666. Free Energy of Transition of Iron ($\alpha \rightleftarrows \gamma$). Yap and Chu-Phay. *Faraday Soc., Trans.* 28. *pp.* 781–788, *Nov.*, 1932.—A strictly formal and empirical treatment of the free energy of transition of iron, $\alpha \rightarrow \gamma$, from room-temperature to 1400° C. has been given on the basis of the specific heat of iron. The free energy of transition at high temperature is very small, but $\alpha = \gamma$; $\Delta F_{298} = 822$ cal./gm.-atom. Some discussion on the phenomenon of reversible polymorphism and on the possibility of non-allotropy of iron has been included. H. H. Ho.

667. Free Energy, Entropy and Heat of Formation of Iron Carbide (Fe_3C). Yap, Chu-Phay and C. L. Liu. *Faraday Soc., Trans.* 28. *pp.* 788–797, *Nov.*, 1932.—The theoretical basis of the different free energy equations involved in the calculations of the ΔF and ΔH of Fe_3C is first discussed. The use of α-Fe as the standard state from room-temperature to 900° C., and then above 1400° C. up to the melting point, and of γ-Fe as the standard state from 900° to 1400° C., has been introduced to avoid confusion in the free energy calculations. The theory of CH_4/H_2 and CO/CO_2 equilibria with austenite solid solution and Fe_3C is also discussed, and a simple graphical method presented of obtaining the CO_2/CO^2 constants at very high temperatures (above $A_1 = 720°$ C.). The following important thermal data are obtained: $3\,\alpha\text{-Fe} + C = Fe_3C$; $\Delta F°_{9-298} = 9300$ cal./mol.; $\Delta H_{298} = 12{,}300$ cal./mol.; $\Delta S_{298} = 9 \cdot 9$ cal./mol.; $S_{298} = 31 \cdot 8$ cal./mol. Other values of ΔF and ΔH are also obtained, and the change in the value of ΔF_5 and ΔF_9 is shown graphically. From its free energy of formation, Fe_3C is stable above 750° C. A solid solution like austenite behaves as an ideal solution from the standpoint of Raoult's law. H. H. Ho.

668. Heat of Formation of Hydrogen Chloride and Related Thermodynamic Data. F. D. Rossini. *Bureau of Standards, J. of Research,* 9. *pp.* 679–702, *Nov.*, 1932.—Calorimetric determination of the heat of formation of gaseous hydrogen chloride at 1 atmosphere pressure gave $\Delta H°_{298 \cdot 1} = -22{,}063 \pm 12$ gm. cal.$_{15}$ mol.$^{-1}$. Existing data on its free energy and entropy of formation are correlated and are shown to be in agreement with this result. Values of the apparent and partial molal heat capacity and heat content for hydrogen chloride, and for water in aqueous solution of hydrogen chloride at 25° C., are calculated and recorded for the entire concentration range. The following data are also calculated: change in heat content for the solution of 1 mole of gaseous hydrogen chloride in an infinite amount of water $-17{,}880 \pm 40$; for the formation from their elements of silver and mercurous chlorides $-30{,}304 \pm 40$ and $-31{,}580 \pm 45$ gm. cal.$_{15}$ mole^{-1}, respectively; for the formation of aqueous hydrogen chloride at infinite dilution $-39{,}943 \pm 40$ gm. cal.$_{15}$ mole^{-1}; the free energy of formation of gaseous hydrogen chloride $-22{,}775 \pm 12$, and the entropy of aqueous hydrogen chloride in a hypothetical 1 molal solution $13 \cdot 40 \pm 0 \cdot 15$ gm.-cal. mole^{-1} °C.$^{-1}$. N. M. B.

669. Origin of Zero-Point Entropy. K. Clusius. *Nature,* 130. *pp.* 775–776, *Nov.* 19, 1932.—Observations upon the zero-point entropy of the following substances: N_2, CO_2, CO, N_2O, NO. The first two molecules are asymmetric, the others symmetric. Real equilibrium is not reached on cooling to the region of absolute zero: a fully ordered crystal does not occur for such asymmetric molecules as those mentioned above. Further work is promised at liquid helium temperatures. F. I. G. R.

See also Abstracts 643, 651, 659, 673, 742, 750.

VAPOUR PRESSURE.

670. Vapour Pressure of Water over Aqueous Solutions of Potassium Hydroxide. Y. Kobayashi. *Hiroshima Journ. Sci.* 2. *pp.* 269–274, *Oct.*, 1932. *In German.*—The author, in collaboration with E. Shibata and S. Furukawa, published a paper (see *J. Chem. Soc. Japan.* 52, 1931, 404) on the changes of the free energy and the heat developed in the differential dilution of aqueous solutions of KOH of different concentrations at 25° C. This was achieved by measuring the e.m.f. and its temperature coefficient in the case of the following cell: $H_2(Pt)/KOH(m)$, HgO/Hg. In order to convert the readings of the potentiometer to values corresponding to a hydrogen pressure of one atmosphere, a knowledge of the vapour pressure of water over the solutions employed not only at 25° C. but also at the temperatures which were used in the determination of the temperature coefficient, is essential. Being unable to find suitable data in the literature, the author describes investigations made to obtain the required information. These are supplied in four tables, together with a clear graph. T. B.

671. Densities of Saturated Vapours. R. Wright. *J. Phys. Chem.* 36. *pp.* 2793–2795, *Nov.*, 1932.—A small quantity of the liquid is placed in a weighed cylindrical bulb of about 100 c.c. capacity, which is suspended in the outer jacket of an ordinary Victor Meyer vapour density apparatus, in which is placed also 50 to 100 c.c. of the same liquid. The liquid in the jacket is boiled. A suitable current is then passed through a heating spiral under the bulb until the liquid therein is evaporated. The apparatus is then left for 15 minutes, the bulb removed, cooled and weighed. After making a correction for the air which has entered the bulb, the density is calculated from the known volume and weight, the molecular weight being also deduced. The substances dealt with are alcohol, benzene, toluene, chloroform, carbon tetrachloride, acetone and acetic acid. T. B.

672. Low Vapour-Pressure Gauge. K. Newbury and C. L. Utterback. *Rev. Sci. Instruments*, 3. *pp.* 593–595, *Oct.*, 1932.—The gauge is a mercury manometer, in which the movement of one limb is determined by the change in slope of a small mirror hanging from a fixed support and carrying a wire to which a metal cylinder is attached, the latter floating on the surface of the mercury. The change in slope of the mirror is noted by means of a beam of light reflected at its surface. The gauge gives a 25-cm. deflection of the spot of light on a scale for a pressure change of 0·020 mm. mercury. J. H. A.

673. Vapour Pressure Constant of Methane. T. E. Sterne. *Phys. Rev.* 42. *pp.* 556–564, *Nov.* 15, 1932.—It can be shown by statistical quantum mechanics that the vapour pressure constant of a molecule whose principal moments of inertia are all equal to A is

$$i = \log\,(64\pi^5 k^4 m^{3/2} \mathrm{A}^{3/2}/h^6) + \Sigma_r \mathrm{D}_r \log\,(\mathrm{G}_r/{}_r\omega_0)$$

at ordinary temperatures; where m is the mass, k is Boltzmann's constant, h is Planck's constant, the D_r's are the gramme molecular fractions of the two varieties, and where the G_r's and ${}_r\omega_0$'s are constants. It is found that G_1 for methane is 5/12, G_2 is 9/12 and G_3 is 2/12. It is shown by quantum mechanics that ${}_1\omega_0$ for methane is 5, ${}_2\omega_0$ is 9 and ${}_3\omega_0$ is 2; if the spins of the hydrogen nuclei are taken into consideration but the spin of the carbon nucleus neglected, which is permissible. With the value $\mathrm{A} = 5 \cdot 17 \times 10^{-40}$ c.g.s. unit, it is found that the vapour pressure constant in atmospheres and common logarithms of methane at ordinary temperatures should be $-1 \cdot 94$. The experimental result given by Eucken, $-1 \cdot 97 \pm 0 \cdot 05$, agrees with this. AUTHOR.

ACOUSTICS.

674. Reflection of a Sound Wave from a Circular Plate. M. Sasao. *Phys. Math. Soc., Japan, Proc.* 14. *pp.* 510–520, *Oct.*, 1932. *In English.*—A train of plane sound waves was made to fall normally upon a circular plate and reflected, the distribution of intensity on the normal axis was calculated under a few assumptions, and compared with accurate experiments. The experiments were performed in a sound-proof chamber, with two different plates and four different pitches of sound. Near the plate were found interesting phenomena, namely, that the envelope of standing waves, if the wave-length is smaller than the radius of the plate, has a maximum and a minimum, and that the interval between the maxima of standing waves is greater than half a wave-length. These facts were confirmed by theory. AUTHOR.

675. Theory of Acoustic Filtration in Solid Rods. R. B. Lindsay and F. E. White. *Acoustical Soc. of America, J.* 4. *pp.* 155–168, *Oct.*, 1932.—The paper deals with the transmission of longitudinal waves down a solid rod loaded at equal intervals by equal heavy masses which are supposed to move as a whole. By reasoning similar to that employed by W. P. Mason for air filters [see Abstract 2579 (1927)], account is taken of changes in phase, and the system is shown to possess filtration characteristics. Satisfactory agreement exists between the theory and the (unpublished) experimental results of H. F. Olson. The problem of the propagation of transverse waves in a similarly loaded stretched string is solved by the same method and the accepted solution is obtained. A solid rod to which are attached strings loaded with masses at their free ends is also shown to act as a filter. E. J. I.

676. Measurements with Rayleigh Discs. P. Kotowski. *E.N.T.* 9. *pp.* 404–406, *Nov.*, 1932.—It is shown that for the production of Rayleigh discs and other oscillating plates, magnesium, paper and mica are approximately equally good. An increase of sensitivity is possible by changing from the usual circular form to a retangular shape. In non-homogeneous sound fields Rayleigh discs can only be usefully employed on the axis of symmetry. A. W.

677. Brief Survey of Supersonics. J. C. Hubbard. *Acoustical Soc. of America, J.* 4. *pp.* 99–107, *Oct.*, 1932.—A survey and bibliography of work on the various aspects of supersonic vibrations. E. J. I.

678. Magnetostriction Oscillator Producing Intense Audible Sound and Some Effects Obtained. N. Gaines. *Physics*, 3. *pp.* 209–229, *Nov.*, 1932.—Apparatus is developed capable of pushing the magnetostrictive oscillation of nickel to the limit set by its mechanical strength. The intense audible sound produced is introduced under water from beneath the surface, continuous operation of the vibrator being secured by spray cooling. The interiors of corks are charred to cinder by the sound. A fountain 6 cm. high forms on the surface of water, and is proved to be due to pumping action of the reciprocating rod and *not* to radiation pressure. Erosion of metals and of glass by cavitation and resultant water hammer is

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obtained. Colloids of oil and of carbon in water are produced. Curious fatigue effects in glass are observed. Whitened appearance and erratic motions of air bubbles released in water in the presence of the sound are observed, and theory is developed to explain these and the "atomisation" of liquids. Flattening of a drop of liquid against a vibrator is observed and attributed to sonic attraction and to the reaction of sonic radiation. Frogs, fish, larvæ, and water fleas are killed by the sound. Bacteria are killed so quickly that partial sterilisation of milk in continuous process is effected. Striations in a Kundt tube that are parallel to its axis are produced, and an explanatory theory developed. AUTHOR.

679. Scattering of Light by Sound Waves. P. Debye. *Phys. Zeits.* 33. *pp.* 849–856, *Nov.* 15, 1932.—By means of an approximate solution of Maxwell's equations, the paper attempts to give an explanation of results given in a former paper [see Abstract 4457 (1932)]. The theory given leads, however, to results not in accordance with experiment, as it predicts only the first-order spectrum to each side of the primary rays, whereas several spectra on either side have been observed. Possible explanations of the divergence between theory and experiment are put forward, *i.e.*, that the sound waves causing the scattering are not of purely sinusoidal character when several spectra are produced, or, more probably, that when sound waves of large amplitude are present, the variations in the index of refraction are not of sinusoidal form, as assumed in the theory. G. G. S.

680. Measurements of Sound Insulation Properties at Ultrasonic Frequencies. N. N. Malov and S. N. Rschevkin. *Hochfrequenztechn. u. Elektroakustik*, 40. *pp.* 134–136, *Oct.*, 1932.—Measurements were made of the sound insulation properties of a large number of materials for a frequency of 573 kc. A piezoelectric quartz oscillator was used to produce the ultrasonic waves in a tank containing oil, a simple type of disc pendulum being used to measure the radiation pressure. The results show that the sound insulation of homogeneous plates of given dimensions is a function only of the weight of the plate. The index given by the results (2·47) agrees with Sabine's results. The absolute values of the sound insulation at ultrasonic frequencies exceed those found by Sabine at sonic frequencies, as is to be expected on theoretical grounds. A. W.

681. Sound Insulating Properties of Some Types of Structure. H. Kreüger and J. H. Sager. *V.D.I.* 76. *pp.* 964–967, *Oct.* 1, 1932.—An experimental investigation of the sound insulating properties of various materials when used in various ways in direct contact with the beams of a building. As sound source the impulsive sound produced by letting a wooden piston fall from a fixed height on to a second curved wooden block is used. Two microphones are used, either of which can be connected to the amplifying and recording system. One microphone is kept as standard in a sound-proof box covered by a wooden lid on to which the wooden piston can be allowed to fall. The other microphone receives the sound transmitted through the girder or beam when the wooden piston is allowed to fall from a measured height on to the main support of the beam. The material to be tested is between this support and the beam. Fifty-four examples were investigated. W. H. GE.

682. Sensitive Flames. H. Zickendraht. *Helv. Phys. Acta*, 5. *pp.* 317–335, *Nov.*, 1932. *In German.*—The history of sound-sensitive flames is briefly reviewed, and a convenient form for use as a sound recorder is described. This belongs to the group of velocity receivers, having the so-called spring factor J = A.w. The flame is found to be sensitive to sound waves in gases and also to an oscillating electric field. The application of such flames to measurements of sound waves, including ultrasonics, is shown in several examples. H. M. B.

683. New Rectifier for Sound Wave Pressures. F. Ribbentrop. *Zeits. f. techn. Physik,* 13. 9. *pp.* 396–402, 1932.—The alternating pressure of the sound wave actuates a valve consisting of a fly's wing which vibrates in unison with the wave. The valve is open during the pressure phase and closed for the other, and greater efficiency is obtained from a two-way form of the rectifier. The pressure is measured by a flat-V alcohol manometer. Methods are described for calibrating the instrument, the indications of which are independent of the frequency up to 800; thereafter the sensitiveness decreases. As examples of the use of the instrument, measurements are given of the distribution of pressure in stationary waves in tubes. The range of the instrument is 50 to 8000 bar. [See also Abstract 724 (1930).] G. E. A.

684. Position Finding by Under-Water Sound Signals. B. R. Hubbard. *Acoustical Soc. of America, J.* 4. *pp.* 138–154, *Oct.*,1932.—A survey of methods of under-water position finding and sound ranging, including: (*a*) Synchronous signals—measurement of the interval between the reception of two dissimilar signals simultaneously created at the same point. The submarine-sound and radio combination is advocated and described. (*b*) Echo depth sounding. (*c*) Sound spotting—a system similar to ordinary land sound-ranging. (*d*) The multiple unit method in which the observer makes an adjustment to obtain binaural balance. E. J. I.

685. Propagation of Waves of Expansion in Sea-Water. K. Kitagawa. *Kyoto Coll. Sci., Mem.* 15. *pp.* 327–340, *Sept.*, 1932. *In French.*—The equation of motion of a sound wave in sea-water is established in terms of the speed at sea-level, depth of the point considered, and the coefficient of cubical expansion, and a general solution is obtained. The path of a ray obliquely incident on the surface is a parabola concave to the surface, and its maximum range on the surface and radius of curvature are calculated, and a formula is deduced for depth sounding. G. E. A.

686. Theory of Vibration of Japanese Hanging Bells. K. Yamashita. *Kyoto Coll. Sci., Mem.* 15. *pp.* 315–322, *Sept.*, 1932. *In English.*—The shape of the bell is roughly a circular cylinder with a hemispherical cap. It is thick at the edge and at the top, and thin where the change of shape occurs. In the theory, uniform thickness is assumed, and the frequencies of the partials of a bell in which the length of the cylinder is 3/2 its radius and Poisson's ratio is 1/3, are as 359 : 981 : 1847: etc. G. E. A.

See also Abstract 569.

ELECTRICITY AND MAGNETISM.

ALTERNATING-CURRENT NETWORKS.

687. Theory of Electric Filters. V. Bubenick. *Comptes Rendus*, 195. *pp.* 1002–1004, *Nov.* 28, 1932.—The mathematical theory of electric filter circuits is very briefly developed. J. S. G. T.

See also Abstracts 486, 776.

CONDUCTION AND DISCHARGE IN GASES.

688. Starting of Gas Discharges. W. Rogowski. *Phys. Zeits.* 33. *pp.* 797–808, *Nov.* 1, 1932.—A theoretical discussion is given of the starting or ignition of gas discharges, the view being taken that the electrical effects and not the optical effects are of outstanding importance. Townsend's theory is considered first, then ionisation, space charges and the starting of the glow discharge. A few experimental results are given which support the conclusions arrived at in the theoretical discussion. A. W.

689. Physical Basis of Grid Control of Gas Discharges. A. Glaser. *Zeits. f. techn. Physik*, 13. 11. *pp.* 549–558, 1932.—A general discussion from the physical standpoint of the properties and operation of gas discharge tubes with control grids, with special reference to mercury-vapour tubes of the thyratron type. A. W.

690. Energy Conditions of Gas Discharges. M. Steenbeck. *Phys. Zeits.* 33. *pp.* 809–815, *Nov.* 1, 1932. *Zeits. f. techn. Physik*, 13. 11. *pp.* 575–576, *Nov.* 1, 1932.—A theoretical paper giving a general discussion of gas discharges of various types from consideration of the energy conditions. A. W.

691. Theory of Electric Arc Plasma. D. Gábor. *Zeits. f. techn. Physik*, 13. 11. *pp.* 560–563, 1932.—The electrons in the positive column of an electric arc have a Maxwellian velocity distribution, which the work of Langmuir shows to be built up very rapidly and to be re-established after disturbance in an extremely short relaxation time. Calculations made by the author reveal such an intense interchange of energy between the electrons that the values found for the relaxation time are of the order of magnitude of those actually observed. Langmuir's calculations showed a considerable discrepancy between the calculated and observed values. A. W.

692. Kathode Material and Discharge Delay. R. Strigel. *Arch. f. Elektrot.* 26. *pp.* 803–806, *Nov.* 4, 1932.—It is known that electric breakdown is started by the individual electron canals [see Abstract 5191 (1932)]. Discussion of this leads to the conclusion, which is also verified experimentally, that the discharge delay of different materials under similar conditions is determined only by the work of extracting the electrons from the electrode at negative potential, and that the discharge delay is therefore completely independent of the material of the electrode at positive potential. A. W.

693. Electron Diffusion, Electron Attachment and Ageing of Negative Ions in Commercial Nitrogen at Atmospheric Pressure. J. Zeleny. *Frank. Inst., J.* 214. *pp.* 513–532, *Nov.*, 1932.—A criticism by Loeb and Bradbury [see Abstract 2979 (1932)] of the author's interpretation of the experimental results of that part of a previous paper which dealt with the ageing of negative ions in commercial nitrogen is shown to be invalidated by a mistake in their analysis and by assumptions which do not represent facts with sufficient accuracy. A more extended analysis of the previous work and new evidence which is given confirm the correctness of the former contention that the negative ions in question changed in size with age. The lateral spread, owing to diffusion, of a stream of electrons in this nitrogen at atmospheric pressure, when moving in an electric field of about 100 volts/cm., was found to be very nearly the same as that for positive ions under like conditions. The average energy losses of the electrons at collision with the molecules must therefore have nearly balanced the gains from the electric field, and hence were greater than would result from purely elastic collisions. The experimental results indicate that in fields down to at least 20 volts/cm. nearly all of the attachment of electrons to molecules in the gas used occurred close to the place of their liberation. AUTHOR.

694. Non-Existence of Ion Mobility Spectrum in Air. R. N. Varney. *Phys. Rev.* 42. *pp.* 547–555, *Nov.* 15, 1932.—A modified form of the Rutherford a.c. method of measuring ion speeds, as suggested by Loeb and Bradbury [see Abstract 1712 (1932)], has been used to investigate the range of speeds with which negative ions in air travel. It differs in that the ions are produced only during a small fraction of the a.c. period, this being accomplished by interrupting the ultra-violet light beam with a rotating shutter. The theoretical curves of $d(i/i_0)/dV$ against V assuming both the presence and the absence of an ion spectrum are given. The experimental curves for ions 0·03 to 0·006 sec. old agree closely with the theoretical curves for a spectrum, but it is shown that on application of a diffusion correction the spectrum in clean dry air reduces to negligible width; the presence of ozone in considerable amounts, however, produces a spectrum extending 10 to 12 % on each side of the mean mobility. AUTHOR.

695. Liberation of Electrons from a Metal under Bombardment by Slow Positive Ions. G. Valle. *Accad. Sci. Torino, Atti,* 67. 14–15. *pp.* 490–499, 1931–1932.—The various controversial theories and experimental results relating to γ, the number of electrons liberated when a positive ion impinges on a kathode, are first discussed. An indirect theoretical method of attack is afforded by consideration of the curves connecting sparking potential between plane parallel electrodes with pL, the product of the pressure of the gas and the distance between the electrodes. The results of the analysis for air favour the theory that the whole effect is due to the action of the moving ions and not to the presence of an ionic double layer at the surface of the kathode. That part of the action due to electrostatic attraction is shown to increase with decreasing velocity of the positive ion, to reach a sharp peak value and then to fall abruptly to zero. The method admits of a calculation of the minimum potential drop, of the order of 1 volt, for which an ion will extract electrons from the kathode. F. C. C.

696. Hittorf Dark Space and First Kathode Layer of a Glow Discharge. W. Weizel. *Phys. Zeits.* 33. *pp.* 887–888, *Nov.* 15, 1932.—A new theory of the processes leading to the formation of the Hittorf dark space and the first kathode layer of a glow discharge is propounded. The basic assumption of the theory is that the motion of the positive ions near the kathode gives rise to a decrease of gas density in the Hittorf dark space and a considerable increase of gas density immediately in front of the kathode. An explanation of many outstanding difficulties in the theory of the glow discharge can be given on this assumption. J. E. K.

697. Cold Kathode Vacuum Arc. F. H. Newman. *Phil. Mag.* 14. *pp.* 788–794, *Nov.*, 1932.—The starting and maintenance of cold kathode arcs are considered to be due to the presence of spots of impurities on the kathode metal, at least in the case of highly refractory metals, *e.g.*, tungsten. Starting of the arc is associated with an initial momentary electrical discharge, giving a kathode fall of about 100 volts and producing ions in the gas. Thermionic emission is not involved in the starting process. J. S. G. T.

698. Mercury-Arc Phenomena. J. Kömmnick. *Ann. d. Physik*, 15. 3. *pp.* 273–299, *Nov.*, 1932.—Langmuir's probe method was employed in observations at various vapour pressures of the potential distribution, the electron temperature, the carrier concentration and the carrier current density in the mercury arc. The kathode fall of potential and that in the dark space increase with decrease of the vapour pressure, and in the dark space a back e.m.f. is developed. The measurements in the neighbourhood of the kathode are not in opposition to Langmuir's theory of kathode spots. For elucidating the phenomena in the dark space, observations of diffusion effects were made. With lower vapour pressures the axial and radial fields in the positive column, as well as the carrier current density and concentration, were smaller. The carrier concentration was found to be a multiple of that of the electrons. The results are discussed, and from the discussion it appears that negative ions play an important part in the discharge, as do also the negative charges on the walls. Proof of this is given by the unvarying length of the dark space at different vapour pressures. Negative anode falls were not observed with fully developed positive columns. Measurements of the arc potential for different lengths of arc showed that with a movable anode field strength measurements could be made, with certain limitations, in a fully developed positive column in a similar manner to measurements with probes. A. W.

699. Potential Gradient in the Positive Column in the Rare Gases. A. Lompe and R. Seeliger. *Ann. d. Physik*, 15. 3. *pp.* 300–317, *Nov.*, 1932.—The gradients in the unstriated positive column in the rare gases have been previously discussed with reference to the theory of the positive column [see Abstract 3397 (1932)]. In order to obtain more exact data, very careful measurements were made of the gradients in the positive column of discharges in He, Ne and A. Some thousands of measurements were made under conditions of guaranteed accuracy and reproducibility; the results are given in numerous curves and are discussed in their bearing on the theory previously given. A. W.

700. Energy Balance in the Positive Column of a Discharge in Sodium Vapour. M. J. Druyvesteyn. *Phys. Zeits.* 33. *pp.* 822–823, *Nov.* 1, 1932.—Measurements of the radiated energy and of the losses at the tube walls of discharges in Na vapour showed that in pure Na vapour the total power losses were equal to the radiated energy plus the losses at the tube walls. This was found to hold for tubes of 3 to 4 cm. dia. and currents from 0·2 to 3·0 amperes, with a possible error of 5 %. If, however, the discharge tube contained only a little gas (*e.g.*, 2×10^{-4} mm.), the power consumption was greater than the radiation plus the losses at the walls. This may possibly be due to the formation of negative ions. For small currents and gas pressures Mohler's results for Cs vapour are in agreement with those here given for Na vapour, but for greater currents and pressures Mohler found an energy loss whose origin could not be definitely assigned. [See also Abstract 4530 (1932).] A. W.

701. Mobile Layers in the Positive Column of the Inert Gases. W. Pupp. *Phys. Zeits.* 33. *pp.* 844–847, *Nov.* 1, 1932.—Investigations on the mobile layers in the positive columns in the gases He, Ne, A and Kr, with pressures ranging between ½ to 5 mm. of Hg and current densities from ½ to 15 amperes, have been carried out in some 10 discharge tubes of different lengths and widths. To measure the widths of the layers, two photoelectric cells are used in conjunction with a Braun cell. A series of curves are given for A, with layer widths as ordinates, current strengths as abscissæ, and the pressure, which is increased by equal amounts, as parameter. All the curves at the low current end come to the same limiting layer width of about 5 cm. For a current strength greater than a certain limit, layers of constant velocity can no longer be obtained. Using an arrangement of a photoelectric cell, two Braun cells and a high resistance probe, straight line relations are obtained between probe potential and current strength. Six separate phases are investigated. In the luminosity maximum corresponding to phase 1, the electrons give up so much energy that shortly before entering phase 2 they are at their lowest temperature. The temperature rises slowly throughout the dark space. At phase 5, shortly before the luminous layer begins, the energy of the electrons has reached its maximum. Somewhat similar results are obtained for the ionic current; the measurements are not yet concluded. F. C. C.

702. Velocity Distribution among Electrons in the Positive Column. M. J. Druyvesteyn. *Phys. Zeits.* 33. *pp.* 856–863, *Nov.* 15, 1932.—The diffusion of electrons in a positive column of low current density is investigated. Using the equation of Hertz for electron diffusion, together with certain simple assumptions concerning the excitation and ionisation probabilities and the mechanism by which currents flow to the walls, the velocity distribution of the electrons and the amount of ionisation in the positive column are calculated. Combining these results with equations for ionic diffusion given by Schottky and by Tonks and Langmuir, the gradient of the column is calculated. The results are applied to Ne; as, however, for this gas the excitation probability is unknown, the values are first related to α, the Townsend constant. F. C. C.

703. X-Ray Study of the Density Distribution in a Discharge Tube. Y. Ishida and T. Suetsugu. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers. No.* 395. *pp.* 185–188, *Nov.*, 1932. *In English.*—X-ray photographs are given of mercury-vapour discharge tubes (*a*) with no discharge passing and (*b*) with discharge passing. The latter show plainly the distribution of the Hg vapour along the discharge path. It was found that in all cases the X-ray photographs remained almost the same for several minutes after stopping the discharge, showing that the distribution of electrons and gas atoms persists for some time after the discharge stops. A. W.

704. Investigation of Mercury-Vapour Discharges. E. Lübcke. *Phys. Zeits,* 33. *pp.* 890–895, *Nov.* 15, 1932. *Zeits. f. techn. Physik,* 13. 11. *pp.* 558–560, 1932.—In a 3-electrode incandescent-kathode discharge tube filled with Hg vapour the ratio of the pre-discharge currents to the grid and anode respectively provides a possible means of testing the law of the probability of ionisation and of extending it to higher potentials. At low anode potentials the behaviour of the ionisation probability causes a curvature of the so-called ignition characteristic. Probe measurements in the Hg low-pressure arc show that the concentration of the electrons is smaller than that of the positive ions. From this it is concluded that heavy negative carriers must exist in the discharge tube. These carriers are drawn from the arc discharge and appear as anode canal rays. The results obtained also indicate the existence of a number of simpler negative ions. A. W.

705. Ionised Gases in the Magnetic Field; Pressures less than 10^{-3} mm. of Mercury. T. V. Ionescu and C. Mihul. *Comptes Rendus*, 195. *pp.* 765–767, *Nov.* 7, 1932.—The effects of pressure and of the presence of water vapour upon the conductivity of ionised air, nitrogen and hydrogen in a magnetic field are investigated and discussed. J. S. G. T.

706. New Methods of Mass Spectrometry. J. Mattauch. *Phys. Zeits.* 33. *pp.* 899–903, *Nov.* 15, 1932.—The author gives a full description of a new mass spectrometer similar to one previously constructed by Smythe and Mattauch [see Abstract 3940 (1932)] and employing the Smythe system of condensers, which sorts out all particles having a given velocity irrespective of their masses. The mass analysis of the particles is then accomplished, using a radial electric field. W. S. S.

707. Special Method for the Production of Positive Rays. W. Reusse. *Ann. d. Physik*, 15. 3. *pp.* 252–255, *Nov.*, 1932.—An auxiliary kathode in the form of a small aluminium plate placed below and just in front of the main kathode is situated a short distance from a heated tungsten wire. The wire and the main kathode are at the same negative potential, but the auxiliary kathode is at a higher potential of about 100 volts (the auxiliary potential). With the temperature of the wire kept constant, the potential across the discharge tube is constant for an auxiliary potential greater than 50 volts. For a constant auxiliary potential of 100 volts, a marked decrease in working potential occurs with increase of temperature of the wire. The intensity of the positive rays issuing from the far side of the kathode shows a marked maximum when the current from wire to auxiliary kathode is 1 mA; the potential across the main tube is then about 8 kV, while the optimum pressure is about 2×10^{-2} mm. of Hg. With alternating potential across the tube, an auxiliary current of 1 mA and a pressure of 8×10^{-3} mm. of Hg, the intensity of the positive rays is nearly double that with a direct potential. Magnetic deflection of the rays gives sharp separation of H^+ and H_2^+. F. C. C.

708. Loss of Energy of Slow Positive Rays in their Passage through Matter. W. Reusse. *Ann. d. Physik.* 15. 3. *pp.* 256–258, *Nov.*, 1932.—Positive rays are rendered homogeneous in velocity by a magnetic field, and the energy loss after passage through celluloid foils of thicknesses ranging from 20 to 120 mμ is found from the deflections of the rays in a second magnetic field. A special arrangement of condenser and electrometer tests the efficiency of the Geiger counter used for the detection of the rays. The efficiency is independent of the energy if the latter is greater than 8 kV. Corrections are given for lower energies. For equal thicknesses of foil the energy losses from 4 to 20 kV vary directly as the primary energy, and are therefore proportional to the square of the velocity. Curves are drawn, and extrapolation suggests that higher energy losses are directly proportional to the velocity, in agreement with Eckardt [see Abstract 3813 (1930)]. F. C. C.

709. Gas Concentration of Electron Beams. W. Rogowski and H. Graupner. *Arch. f. Elektrot.* 26. *pp.* 807–810, *Nov.* 4, 1932.—A cylindrical constant positive space charge is assumed, and an explanation is given of the behaviour of an electron beam travelling within such a positively charged cylinder from a surface source. This leads to a better understanding of certain properties of electron rays. A. W.

710. Space-Charge Field of Gas-Concentrated Electron Beams. K. Engel. *Zeits. f. Physik*, 79. 3–4. *pp.* 231–234, *Nov.* 14, 1932.—From the distances apart of the nodes observed in beams of slow electrons calculations are made of the magnitudes of the positive space charges within the beam. The results show that at any rate to a first approximation the space charge is constant along the beam. A. W.

711. e/m Measurements of Filament Rays. K. Siebertz. *Phys. Zeits.* 33. *pp.* 895–897, *Nov.* 15, 1932.—Filament rays (electrons confined to move in a fine stream by gas ionisation, as in the kathode-ray oscillograph) were subjected to magnetic deflection and the radius of curvature was measured. As in the classical *e/m* determinations for the electron, an *e/m* value for the filament could be found knowing the magnetic field intensity, the radius of curvature and the electric accelerating potential difference. The latter was obtained as the difference of potential between the oxide kathode emitting the filament ray and an auxiliary heated filament electrode introduced into the gas space. The measurements led to values of *e/m* which are appreciably higher than the value appropriate to the free electron, the difference being of the order of 10 %. In discussing the results, possible distributions of potential in the neighbourhood of the filament ray are indicated. W. S. S.

712. Ignition of Vapours by Electric Sparks. A. Kling and A. Soulier. *Comptes Rendus*, 195. *pp.* 1024–1026, *Nov.*, 1932.—The origin of fires of hydrocarbon or petrol vapours is often asserted to be an electric spark. However, the spark from a Wimshurst machine is capable of igniting such vapours only when adequate condensers are added to increase the spark. Frictional electricity is therefore deemed inadequate to explain fires during dry-cleaning of artificial silk, and such fires can be attributed to sparks only from faulty electrical apparatus. A. S. C. L.

713. Optical Investigation of the Spark Flame in Air at Atmospheric Pressure Produced by an Impulse Generator. W. Holzer. *Zeits. f. Physik*, 77. 9–10. *pp.* 676–694, *Aug.* 24, 1932.—By means of a suitable optical system the process of the ionisation of the air and production of a spark is examined. The work embraced sparks produced by an impulse generator over a range of voltages from about 40 to 160 kV, using electrodes of several shapes, including in particular disc and point-plane types. For comparison purposes the sparks produced by corresponding constant voltages were also studied. The results show that the different modes of excitation and different electrodes produce very different sparks, and preliminary ionisations of diverse types. G. E. B.

714. Design of Pressure Ionisation Chambers. J. H. Williams. *Rev. Sci. Instruments*, 3. *pp.* 586–592, *Oct.*, 1932.—Two ionisation chambers are described which are suitable for the measurement of hard X-rays and α-rays. One of them is designed to be used at 30 atmospheres and the other from 60 to 100 atmospheres. The method of assembling and testing the chambers is described. AUTHOR.

715. Lichtenberg Figures in Gases and Liquids. Y. Toriyama. *Phys. Math. Soc., Japan, Proc.* 14. *pp.* 430–441, *Sept.*, 1932. *In English.*—The author gives examples of Lichtenberg figures produced upon the surface of solids when immersed in a gas or a liquid. It is concluded that the mechanism of a spark can be divided into two stages in the first of which positive and negative figures develop independently. In the second stage the second negative streamer spreads towards the positive electrode along the positive figure and a complete sparkover takes place when it reaches the positive electrode. The investigation with a liquid dielectric shows that there is a relation between the size of the dust figures and the breakdown voltage of the liquid. From other experiments it is deduced that the dust figures in a liquid are due to electronic and not ionic phenomena. J. E. R. C.

716. Ionisation of Gas in a Magnetic Field. T. V. Ionescu and C. Mihul. *Comptes Rendus*, 195. *pp.* 1008–1010, *Nov.* 28, 1932.—Measurements were made of the conductivity and the dielectric constant of air, H_2 and N_2 for pressures greater than 10^{-3} mm. Hg. For H_2 and N_2 the measurements are easy and the same results are always found for the same pressures. With air the measurements are more difficult. The form of the curves remains the same in successive tests, but the values are not reproduced exactly. Curves are given showing the variation of the conductivity with increase of the magnetic field and also with increased pressure. With no magnetic field the conductivity increases with the pressure. Pressures were found for which with the application of a magnetic field maxima other than those due to free electrons could be obtained. With very intense fields only the vibrations due to the free electrons remained, the others disappearing. The values of the magnetic field giving maximum conductivity varied with the pressure. The dielectric constant also undergoes changes characteristic of resonance phenomena. A. W.

See also Abstracts 591, 597, 598, 599, 627, 791, 806, 807.

CONDUCTION IN SOLIDS AND LIQUIDS.

717. Electron Theory of Metals. R. Peierls. *Ergeb. d. Exakt. Naturwiss.* 11. *pp.* 264–322, 1932.—A mathematical paper on the present state of the electron theory of metals. The matter is divided into four main chapters dealing (I) with the motion of electrons, (II) with electrons in thermal equilibrium, (III) the non-steady state when the temperature is high, and (IV) the non-steady state at low temperatures. In (II) such matters as thermionic emission, contact potential and " cold " electron emission are dealt with, whilst the ordinary thermoelectric effects fall under (III). Supraconductivity is left to a short chapter, No. V, and is not considered to be a property of an ideal metal. J. H. A.

718. Lorentz-Lorenz Correction in Metallic Conductors. R. de L. Kronig and H. J. Groenewold. *K. Akad. Amsterdam, Proc.* 35. 7. *pp.* 974–978, 1932.—If α is the polarisability of a single atom in a dielectric, then, applying the Lorentz-Lorenz correction, the refractive index is given by $\frac{n^2-1}{n^2+2} = \frac{4\pi}{3}N\alpha$ (N equals the number of atoms per unit volume) in place of the simpler law $n^2 - 1 = 4\pi N\alpha$. The authors inquire whether the Lorentz-Lorenz correction should be applied when dealing with dispersion in metallic conductors. Taking as model of a metallic conductor a uniform continuous distribution of positive charge in which is embedded a simple cubic lattice of electrons, they show that the index of refraction may be calculated treating the electrons as free and omitting the Lorentz-Lorenz correction. A discussion of the case when the electrons combine the properties of free and bound electrons, as in Bloch's quantum theory of metallic conduction, is to be published later. W. S. S.

719. Conductivity of NaCl Crystals Under Pressure. Z. Gyulai. *Zeits. f. Physik*, 78. 9–10. *pp.* 630–638, *Oct.* 18, 1932.—Measures the conductivity of NaCl crystals in the form of pastilles made of dry salt compressed by a steel rod in a quartz tube. Under this compression from all sides the salt shows a sudden diminution of conductivity when a sudden pressure is applied. This behaviour is opposite to that observed with pressure on only two sides [see Abstract 950 (1929)]. The author indicates further experiments to decide whether it is the "reticular" ions that exclusively make up the conductivity, or whether unattached electrons play a perceptible part. E. E. F. d'A.

720. Resistivity of Polycrystalline Wires in Relation to Plastic Deformation and Mechanism of Plastic Flow. E. N. da C. Andrade and B. Chalmers. *Roy. Soc., Proc.* 138. *pp.* 348–374, *Nov.* 1, 1932.—The specific resistance of certain metals at various stages of plastic flow under relatively large stress has been determined. The resistance of metals such as Cu and Al, which crystallise in the cubic system, is not influenced by flow, whereas for metals crystallising with a unique axis of symmetry, such as cadmium and tin, the resistance remains constant during the immediate extension and the final flow at constant rate, but changes by up to 2 % during the intermediate stage of flow at diminishing rate ("β-flow"). The changes are attributable to slip of the crystallites, with consequent rotation of the unique axis. This hypothesis is in accordance with the magnitude and direction of the changes observed, and is supported by the reversed direction of the change (caused by twinning) observed when Cd is stressed at −180° C., *i.e.*, at a temperature at which the β-flow cannot take place. H. F. G.

721. Variation of the Electrical Resistivity of Quartz with Temperature. S. Shimizu. *Tokoku Univ., Sci. Reports*, 21. *pp.* 439–454, *Oct.*, 1932. *In English.*—The author has shown [see Abstract 2936 (1932)] that the resistivity of quartz increases with the time for which the polarising potential is applied to it. The effect of increase of temperature upon this phenomenon is now investigated. Two quartz plates were used, the one cut perpendicular to the optic axis and the other Curie cut. If $R =$ true resistivity and $R_{30} =$ resistivity after 30 minutes, it is shown that for both specimens R_{30}/R increases at first as the temperature increases and then falls towards unity. This effect is ascribed to an increase of surface leakage with temperature and to a decrease of the polarising potential. By an adaptation of the apparatus it was shown that this explanation is true. It appears that the length of the leakage path affects the value of the resistivity obtained. J. E. R. C.

722. Electrical Conductivity of Mercury at High Temperatures and Pressures. W. Braunbek. *Phys. Zeits.* 33. *pp.* 830–831, *Nov.* 1, 1932.—A preliminary description of an apparatus used for determining

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the electrical conductivity of mercury at temperatures up to 650° C. and at a pressure of 300 atmospheres. There is an approximately linear relationship between conductivity and temperature in the range 0° to 650° C., the effect of pressure being small (about 1 % at 300 atmospheres).
G. G. S.

723. Temperature Coefficient of Resistivity of Silicon and a Thermoelectric Phenomenon of Unipolar Substances. C. Bedel. *Comptes Rendus*, 195. *pp*. 871–873, *Nov*. 14, 1932.—The ends of a fragment of silicon when heated to a constant temperature exhibit a p.d.; this with pure silicon in fragments is 0·4 mV at 100° C., in crystal form 3·6 mV at 330° C. Carborundum, pyrites and galena behave similarly [see Abstract 2655 (1930)]. This effect is due to the equal and opposite currents produced at the ends by the thermoelectric effect combined with the rectifying power of a unipolar substance. The temperature coefficient of resistivity of silicon cannot therefore be determined, as there are three superposed actions: the thermoelectric effect, dielectric conductivity at the contacts, and conductivity proper of silicon; it is, however, certainly negative for pure silicon. The resistivity of silicon containing 0·1 % of iron increases continuously to 400°, but with 1·6 % iron there is a minimum at 210°, above which it is positive. [See also Abstract 1352 (1931).] C. A. S.

724. Resistance Anomaly in Pure Bismuth. C. Drucker. *Zeits. f. phys. Chem*. 162. *Abt.A*. 4–5. *pp*. 305–317, *Nov*., 1932.—Careful experiments are described which have confirmed the existence of an anomalous variation with temperature of the resistance and the temperature coefficient of resistance of pure bismuth. Pure bismuth pressed into a wire while at a temperature below its melting point has a varying temperature coefficient which increases with decreasing temperature. Bismuth wire prepared at a temperature below 100° shows a sharp discontinuity in its temperature coefficient at about that temperature whereby it acquires an increased negative temperature coefficient. For wire prepared at a higher temperature it is possible to reduce the magnitude of the anomaly by a tempering process. The effect is ascribed to structural changes in the material.
J. E. R. C.

725. Supraconduction. M. v. Laue. *Phys. Zeits*. 33. *pp*. 793–796, *Nov*. 1, 1932.—(1) Its disturbance by a magnetic field.—De Haas and Voogd in 1931 published measurements on the magnetic raising of supraconduction in tin crystals and referred to a magnetic field parallel to the metal wire and again to one at right-angles to the same without fixing these directions very exactly. The author points out that the resistance in both cases depends in various ways on the magnetic field. Different examples are given to illustrate this. (2) Two researches of Sizoo.—Sizoo sent a current through two supraconducting coils of various thickness of wire arranged in parallel. Its distribution between the two coils could be determined by external measurement of the magnetic field. A magnetic field may, however, not be observable. With certain relations of the self-induction and mutual induction and when $I_1 = I_2$ the magnetic energy may vanish. The investigation is an example of the rule: Between several supraconductors arranged in parallel a given current distributes itself so that the magnetic energy is a minimum. J. J. S.

726. Supraconductivity. W. Meissner. *Ergeb. d. Exakt. Naturwiss*. 11. *pp*. 219–263, 1932.—A critical survey of the facts discovered in connection with supraconductivity, followed by a discussion of the general form which a successful theory may be expected to take. It is stressed that the electrons concerned in supraconductivity must be other than those responsible for the ordinary electric conductivity at higher temperatures. It is considered unlikely that a completely pure single crystal would show the phenomenon. A Bibliography of 121 entries is included. J. H. A.

727. Electric Supraconduction in Metals. J. C. McLennan. *Nature*, 130. *pp.* 879–886, *Dec.* 10, 1932. *Supplement.*—The behaviour of supraconductive metals, alloys and chemical compounds is considered and various constants given. The chief parts of the subject dealt with are: action of a magnetic field and of alternating electric currents, absorption of β-rays by supraconductors, photoelectric and light absorption experiments, experiments with electric fields of radio frequencies and with simultaneous direct and alternating currents. In the *Discussion*, **W. J. de Haas** said that it seemed probable that the electrons go over into a new phase when the metals become supraconductive; **O. W. Richardson** pointed out that there is some resemblance between supraconductivity and ferromagnetism. **W. Meissner** described experiments in which very slow-moving electrons are made to impinge upon a sheet of tin-foil at temperatures both above and below the transition temperature of tin. In conclusion the electron lattice theory, which is described as a promising one, is referred to. J. J. S.

728. Conductivity of Corundum. H. v. Wartenburg and E. Prophet. *Zeits. f. Elektrochem.* 38. *pp.* 849–850, *Nov.*, 1932.—Artificial plates of ruby and corundum are introduced into an electric circuit so that the conductivity is measured at various temperatures up to 2000° Abs. Hevesy's theory points to the conduction below 1900° Abs. being entirely electronic and above partly ionic. The colour change in the formation of ruby shows that it only becomes red after prolonged heating at about 1800° Abs. On tightly clamping ruby and corundum plates together and passing a current at 1900° Abs., no $Cr^{\cdots}$ ions enter the corundum, so it appears that the conduction is purely electronic. H. M. B.

729. Electrical Conductivity and Diagram of State of Binary Alloys. Lithium-Cadmium System. G. Grube, H. Vosskühler and H. Vogt. *Zeits. f. Elektrochem.* 38. *pp.* 869–880, *Nov.*, 1932.—Lithium-cadmium alloys were investigated by the method of thermal analysis by using heating and cooling curves, by determination of the temperature-resistance curves and by measurement of the thermal expansion of the solid alloys. According to the thermal analysis the alloys solidify in 5 different mixed crystal series which are separated from each other by heterogeneous regions. The conductivity isothermals of the alloys which could be examined up to 61·4 % Li showed two pronounced peaks at 25 and 50 % Li. This discovery proved the existence of the compound LiCd already observed by thermal analysis and indicated the appearance of the hitherto unknown compound $LiCd_3$. LiCd crystallised directly out of the molten mass, $LiCd_3$ appeared on cooling of the β mixed crystals separated from it at 370° C. A third hitherto unknown compound, Li_3Cd, is formed according to the results of the thermal analysis and the resistance measurements on the cooling on the γ mixed crystals at 272° C. The results of all the measurements were used to form the diagram of state of the lithium-cadmium alloys. J. J. S.

730. Influence of Time on the Conductivity of Colloids Measured at Different Levels. Papayanno. *Comptes Rendus*, 195. *pp.* 1012–1014, *Nov.* 28, 1932.—A method is described for conductivity measurements at different levels, and various suspensions of mastic, collodion and colloidal silver are examined by its means. It is found for all these systems that the conductivity as a function of the time varies very differently according to the positions of the electrodes. Curves of data are included and the method is proposed for the study of the evolution of colloids. H. H. Ho.

731. B.A. Standards of Resistance, 1865-1932. R. T. Glazebrook and L. Hartshorn. *Phil. Mag.* 14. *pp.* 666–681, *Oct.*, 1932.—A report is made of the changes of resistances of the six B.A. coils which were made up in 1865. Since then they have been tested at frequent intervals and tables and graphs are given, showing the variation with time. This year the insulation resistance has been tested, but while definitely low in some cases, it is not low enough appreciably to affect results. The two platinum coils (which from the temperature coefficient are not pure) have changed the least during the years. Mercury tubes have formed the fundamental standards and more recent values of the B.A. standards have not influenced any actual measurements. H. M. B.

See also Abstracts 428, 559, 655, 741, 775, 788, 801, 803.

DIELECTRICS AND CAPACITANCE.

732. Dielectric Constants of Some Organic Solvent-Water Mixtures at Various Temperatures. G. Åkerlöf. *Am. Chem. Soc., J.* 54. *pp.* 4125–4139, *Nov.*, 1932.—Using a resonance method at a wavelength of 150 m., the dielectric constant at various temperatures has been measured for a series of water mixtures of methyl, ethyl, *n*-propyl, isopropyl, and tertiary butyl alcohols, ethylene glycol, glycerol, acetone, mannitol and cane sugar. Good agreement is found with the literature data, and comparison discussions are given. The equation $D = ae^{-bT}$ is found to be very accurate, D being the dielectric constant, *a* and *b* empirical constants, and T the temperature. Straight-line variation of the log. of the dielectric constant with temperature was generally found in every case over the entire range the measurements had been carried out. Equations for the change with temperature of the dielectric constant of the pure solvents and the solvent-water mixtures have been obtained through large-scale graphical interpolation. A short discussion is included of the polarisation of glycerol-water mixtures. H. H. Ho.

733. Physico-Chemical Method of Analysis in Organic Solution by Measurement of the Dielectric Constant. A. Chrétien and P. Laurent. *Comptes Rendus,* 195. *pp.* 792–794, *Nov.* 7, 1932.—Measurements by a previously described method [see Abstract 3540 (1931)] are given for benzene solutions of mixtures of a number of aromatic acids and bases, *e.g.*, phenol and quinoline, α-dinitrophenol and phenazine, phloroglucinol and pyridine, nitrophenol and α-dinitrophenol with aniline, pyrocatechol and pyridine, etc. It is found by graphical representation that the acidic and basic characters of the various products are rendered clear and in doubtful cases revealed, and that compounds are formed of the nature of salts which would not arise in aqueous solution. H. H. Ho.

734. Behaviour of Thin Films of Cellulose Varnish in Electric Fields. A. Mainka. *Arch. f. Elektrot.* 36. *pp.* 731–743, *Oct.* 7, 1932.—Thin films of cellulose varnish, from 2 to 5 μ thickness, were subjected to constant alternating potentials and the loss factor and capacity measured on Wien's bridge. The results showed at first a slight rise and then a decrease of the loss angle during the application of a constant alternating potential to a virgin film. With repeated application of the potential the loss angle, so long as the potential was applied, was practically constant, falling again in the subsequent resting period. The results show that the loss factor of a virgin film is made up of three parts. The effect of direct potentials was similar to that of alternating potentials, but the changes occurred appreciably quicker. [See also Abstract 599 (1929).] A. W.

735. Variation of Dielectric Constant of Quartz with Applied Potential. H. Saegusa and K. Nakamura. *Tohoku Univ., Sci. and Technol. Reports*, 21. *pp.* 411–438, *Oct.*, 1932. *In English.*—A method is described whereby audible beats between two h.f. oscillatory circuits, one of which is controlled in frequency by a quartz crystal vibrating piezoelectrically, are utilised to measure variations in the capacity of a condenser. The dielectric of this condenser consists of quartz plates cut either parallel or perpendicular to the optic axis. It was found that the dielectric constant of a quartz plate cut parallel to the optic axis is independent of the voltage difference between the faces of the plate, up to 12,000 volts per cm. thickness and up to a temperature of 410° C. The dielectric constant of plates cut perpendicular to the optic axis, however, was found to increase rapidly with both temperature and applied potential. G. G. S.

736. Variation of Dielectric Constant with Temperature. Part II. Electric Moments of Ethylene Halides. E. W. Greene and J. W. Williams. *Phys. Rev.*, 42. *pp.* 119–140, *Oct.* 1, 1932.—An apparatus for measuring the dielectric constant of a vapour as a function of the temperature has been devised, and measurements of dielectric constants and densities of ethylene chloride and bromide are recorded. Deviations from the linear relationship are discussed, and it is suggested that the differences in the experimental data for vapours and for solutions arise from changes in the internal structure of the molecule produced by the solvent. The electric moments of the C—Cl and C—Br bonds have been computed. W. R. A.

737. Measurement of a Small Capacity. H. Lampe. *Zeits. f. Physik*, 79. 3–4. *pp.* 254–263, *Nov.* 14, 1932.—Descriptions are given of an electrostatic and an electrodynamic method of measuring a small capacity. The results of both methods give a deviation of less than 0·1 % from the mean value, showing that under the same conditions of temperature and pressure the capacity is independent of the method of measurement. Further, for the static method, measurements can be made to 10^{-5} and 10^{-6}, showing that it is in no way inferior to the dynamical method. H. M. B.

738. Use of Dipole Moment Data. H. M. Smallwood. *Zeits. f. phys. Chem.* 19. *Abt. B.* 4. *pp.* 242–254, *Nov.*, 1932.—The limits of the validity of measurements of dipole moments have been discussed with special reference to the magnitude of the errors introduced through neglecting to take into account the atomic polarisation or the influence of the solvent. It is suggested that in some cases there exists an alternating effect between the solution medium and the solute. The influence of an electric moment in the CH linking on the estimation of the group moment is discussed and an approximate value of the CH moment is obtained by extrapolation. The relationship between the magnitude of the group moment and the polarity of the linking is also considered. W. R. A.

739. Electric Penetration of Dielectric Liquids as Static Ionisation. H. Eisler. *Zeits. f. Physik,* 79. 3–4. *pp.* 266–274, *Nov.* 14, 1932.—Various views have been brought forward as to the nature of the electric penetration in dielectric liquids. The author takes as the basis phenomenon of the process the static ionisation of the dielectric molecules, and from this hypothesis deduces the function of the current tension. The formula so obtained makes it possible to determine the tenacity or resistance to electric discharge from measurements of the current tension, *i.e.*, without investigations on the penetration. **Errata,** *ibid.*, 79. 11–12. p. 851, Dec. 30, 1932. J. J. S.

See also Abstracts 496, 497, 650, 658, 716.

ELECTROCHEMISTRY.

740. E.M.F. in Liquid Ammonia. G. I. Costeanu. *Comptes Rendus,* 195. *pp.* 778–779, *Nov.* 7, 1932.—With liquid ammonia as solvent and strength of solutions $0{\cdot}1N$ the cells $Pb|Pb(NO_3)_2$, am$|AgNO_3$, am$|Ag$ and $Cd|Cd(NO_3)_2$, $4H_2O$, am$|AgNO_3$, am$|Ag$ give between −65° and −25° e.m.f. expressed by $0{\cdot}462 + 0{\cdot}0005(t + 35°)$ and $0{\cdot}963 - 0{\cdot}00033(t + 35°)$ respectively. C. A. S.

741. Irreversible Processes in Electrolytes: Diffusion Conductance and Viscous Flow in Arbitrary Mixtures of Strong Electrolytes. L. Onsager and R. M. Fuoss. *J. Phys. Chem.* 36. *pp.* 2689–2778, *Nov.*, 1932.—In this mathematical paper the effects of the Coulomb forces between ions on transport processes, *viz.*, diffusion, electrolytic conduction and viscous flow, are considered from a common point of view, and it is shown how results previously obtained for simple electrolytes can be extended to mixtures containing an arbitrary number of ionic species, general limiting laws being derived. As in the case of simple electrolytes the electrostatic effects are found to be proportional to the square root of the concentration. The fundamental equations of the ionic atmospheres lead to systems of differential equations which are compactly treated by matrix algebra, the numerical evaluation of the formal results being illustrated by examples. The electrostatic contribution to viscosity is computed explicitly for the general case, and certain simple cases are discussed in greater detail. The mechanism of force transfer is also investigated. Derivation of the general limiting laws for conduction in mixtures shows that Kohlrausch's rule of the independent migration of ions, valid as a limiting law for simple binary electrolytes, does not apply to mixtures, and that the conductances are not additive; the calculated deviations are compared with the experimental values. The general laws of diffusion are considered with particular references to electrolytes, and the effects of the Coulomb forces are calculated for simple electrolytes and for mixtures; for the former case, the theoretical results are compared with the available data. The rate of production of entropy in transport processes is a quadratic function of the velocities, and the laws of combined diffusion and electric conduction are formulated and discussed on the basis of such dissipation function. T. H. P.

742. Electrolytes in Mixed Solvents. Part IV. Free Energy of Zinc Chloride in Water-Alcohol Solutions. R. T. Hamilton and J. A. V. Butler. *Roy. Soc., Proc.* 138. *pp.* 450–459, *Nov.* 1, 1932.—The partial free energy at 15° of $ZnCl_2$ was deduced from the e.m.f. of cells of the type 1 % Zn in $Hg|mZnCl_2$ in nEtOH + $(100 - n)H_2O|AgCl|Ag$, where $m(= 0{\cdot}01$ to 1) is the number of gramme-molecules of $ZnCl_2$ in 1000 gm.

of solvent, and *n* = 0, 25, 50 and 90 molecular %. The results indicate almost complete dissociation of $\mathrm{ZnCl_2}$ in water, and the reverse in alcohol. Deductions regarding the activity coefficient do not agree with those from Debye and Hückel's theory. C. A. S.

743. Mechanical Stress in Electrolytic Copper Deposited in Presence of Colloids. P. Jacquet. *Comptes Rendus*, 195. *pp*. 952–954, *Nov*. 21, 1932.—Using the same method [see Abstract 3068 (1932)], the effects of serum albumen from ox blood, the same prepared by means of acetone, gum arabic, gum tragacanth, glycocoll and dextrin [see Abstracts 3604 (1930) and 2075 (1931)], are compared with those of gelatin. All cause contraction, but in decreasing degree in the above order, the order being qualitatively that of increasing gold number. C. A. S.

744. Electrolysis of Nickel Salts in a Magnetic Field. H. Forestier. *Comptes Rendus*, 195. *pp*. 954–959, *Nov*. 21, 1932.—A field of 5200 gauss causes considerable retardation in the rate of deposition of nickel from an aqueous solution (6·1 gm./litre) of nickel sulphate when the pH <2·3, and stops it entirely if pH <1. With higher pH there is slight acceleration. With increasing field and *p*H = 1·2 the rate decreases asymptotically to a minimum. With salts of zinc or copper there is slight acceleration for all *p*H values. These facts afford a means of separating nickel and copper in solutions of *p*H = 1–2. C. A. S.

745. Activity Coefficients of Ions. K. Hass and K. Jellinek. *Zeits. f. phys. Chem*. 162. *Abt.A*. 3. *pp*. 153–173, *Nov*., 1932.—Results are given of electromotive measurements of the activity coefficients of $\mathrm{Cl'}$, $\mathrm{Br'}$, $\mathrm{I'}$, $\mathrm{SO_4''}$, $\mathrm{CrO_4''}$ and $\mathrm{C_2O_4''}$ at 25° C. in solutions of various electrolytes over a wide range of concentrations, and of calculations of the activity coefficients of the kations. T. H. P.

746. Anodic Film of Aluminium. Parts I and II. S. Setoh and A. Miyata. *Inst. Phys. and Chem. Research, Tokyo, Sci. Papers, Nos*. 396–397. *pp*. 189–291, *Nov*., 1932. *In English*.—The effect of concentration of the electrolyte upon the formation of an anodic film of aluminium was studied. The electrolyte was an aqueous solution of oxalic acid. The energy efficiency of the film formation was less for alternating current than for direct current. The density of the film was found to be 3·0. Films formed in hot solutions and films formed by the simultaneous superposition of d.c. and a.c. had a strong resistance to corrosion. Superposition of a.c. had no effect on the current efficiency of film formation, irrespective of the concentration. The most suitable concentration of the electrolyte for film formation was from 2 % to 6 %. The behaviour of aluminium in aqueous solutions of oxalic acid was investigated during the formation of the film. F. J. B.

747. Fully Organised Anodic Layers on Aluminium. J. E. Lilienfeld, L. W. Appleton, W. M. Smith and J. K. Nieh. *Am. Electrochem. Soc., Trans*. 61. *pp*. 531–548, 1932.—Experimental evidence is presented which indicates that the materially demonstrable and often visible anodic layer on aluminium and the one acting as the dielectric—the " active " layer—of the electrolytic condenser are essentially identical. It is shown how pure active layers, composed of nothing but the dielectric component, can be produced, and that the discrimination made by previous investigators between the two layers is due to the inclusion, in the compound layers they used, of avoidable, non-dielectric components due to accidental features of their formation. The results now presented are considered in relation to earlier work [Abstract 3651 (1931)]. The hydratability of different layers is discussed as one of their basic characteristics and a view of their molecular structure is advanced. The function of capacity versus formation voltage is found to correspond very nearly with a rectangular hyperbolic function, which follows from the conception of the nature and stratified structure of the layer. The relation between the resistance of the electrolyte and the breakdown voltage is outlined, and also the influence of change of the solvent of the electrolyte on the breakdown voltage, an explanation of these effects being suggested. T. H. P.

748. Overvoltage of Hydrogen. T. Erdey-Grúz and H. Wick. *Zeits. f. phys. Chem.* 162. *Abt.A.* 1–2. *pp.* 53–62, *Oct.*, 1932.—A method of preparing specially pure carbon electrodes is developed. The surfaces were prepared in a state of very great purity, and the overvoltage of hydrogen on these surfaces was measured. The overvoltage of hydrogen on electrodes of lead and tantalum was also determined. The results showed that the theory of Erdey-Grúz and Volmer is complied with if the experimental conditions are such that perfect cleanliness is ensured.
F. J. B.

749. Hydrogen Overvoltage on Mercury Electrodes in Presence of Platinum. I. Šlendyk and P. Herasymenko. *Zeits. f. phys. Chem.* 162. *Abt.A.* 3. *pp.* 223–240, *Nov.*, 1932.—Measurements were made of the current-voltage curves of a dropping mercury electrode, when both hydrogen and small quantities of the platinum metals were deposited. The curves showed two rising portions. The first was shown to correspond to the catalytic deposition of molecular hydrogen by the atoms of platinum. The second portion denoted the deposition on the clean mercury surface. The other metals of the platinum group exhibited similar behaviour. The catalytic deposition of hydrogen was effected by extremely small traces of platinum, 10^{-8} gm.-atom per litre having a marked effect. F. J. B.

750. Mercury Drop Electrode. M. Andauer and E. Lange. *Zeits. f. phys. Chem.* 162. *Abt.A.* 4–5. *pp.* 241–256, *Nov.*, 1932.—The phenomena of the mercury drop electrode, *viz.*, (1) sorption changes at the boundary Hg/solution, (2) change of electrode potential of the drop electrode against the stationary mercury, and (3) current flowing between the dropping and stationary electrodes, indicate that no adsorption and electrochemical equilibria exist between the dropping mercury and the homogeneous solution. Several alternative explanations are considered and rejected on various grounds. It is concluded that the thermodynamic form of the Gibbs adsorption law is not applicable to the dropping electrode. F. J. B.

751. Theory of Concentrated Solutions. Part V. E. Wilke and W. Schränkler. *Zeits. f. phys. Chem.* 162. *Abt.A.* 4–5. *pp.* 361–371, *Nov.*, 1932.—Previous measurements [see Abstract 3984 (1932)] have shown that concentration cells with chlorine, bromine and iodine electrodes give different potentials depending upon the kation. The investigation is extended to the hydrogen electrode in hydrochloric acid, hydrochloric acid in dry methyl alcohol, hydrobromic and hydriodic acids in water solutions, and to amalgam electrodes of the alkali metals. The quantum relationship of the change of radius, previously found for concentration cells of halogen ions, are confirmed for kation cells. F. J. B.

752. Standard Potential and Heat of Dissolution of Gallium. E. S. v. Bergkampf. *Zeits. f. Elektrochem.* 38. *pp.* 847–848, *Nov.*, 1932. The standard potential of gallium in a solution of the ions at unit activity is −0·52 volt at 25° C.; the heat of formation of Ga··· at unit activity from the metal is thus 36·0 k.cal. Direct measurement of the heat of solution in hydrochloric acid yields 32 k.cal. H. F. G.

753. Valve Potentiometer with Glass Electrodes. F. Rosebury. *Indust. and Engin. Chem.* (*Analytical Edition*) 4. *pp.* 398–401, *Oct.* 15, 1932. —An easily operated valve potentiometer for pH measurement is described, in which a glass electrode is employed. The glass electrode has been shown to be applicable to the determination of pH in the presence of substances which seriously interfere with the measurement by other means. The use of low grid-current and low plate voltage is made available for this class of work. F. J. B.

See also Abstracts 498, 617, 659, 662, 665.

ELECTRONS AND PROTONS.

754. Kaufmann-Bucherer Experiments and a Classical Einsteinian Mass Formula. A. Press. *Phil. Mag.* 14. *pp.* 758–764, *Nov.*, 1932.—Heaviside's treatment of a moving charged body is discussed, and it is shown that in experiments for the determination of the ratio e/m, as in those of Kaufmann and Bucherer, it is not, at least classically, justifiable to assume that all variations of the ratio are attributable to changes of the Newtonian mass, m. The apparent charge, q, on an actual spherical electron during an idealised steady flight is shown to be given by $q = q_0(1 - \beta^2/3)$. Very close agreement is found between values of e/m_0 calculated either by means of Einstein's formula $m = m_0/(1 - \beta^2)^{\frac{1}{2}}$ and the formula suggested by the author, *viz.*, $q = q_0(1 - 0{\cdot}58\beta^2)$. J. S. G. T.

755. Magnetic Spectra of Secondary Electrons from Silver. S. Chylinski. *Phys. Rev.* 42. *pp.* 393–399, *Nov.* 1, 1932.—By means of a magnetic analyser and electrometer, the spectra of secondary electrons from silver, when bombarded with kathode rays of energies in the range of 2·1 to 30 equivalent kV, were determined. Each of the kinetic energy distribution curves shows one prominent peak the location of which varies somewhat with the primary voltage. For voltages up to about 10 kV it is located between 0·6 and 0·7 eV_0, where eV is the primary energy; for voltages between 15 and 30 kV it is located between 0·7 and 0·8 eV_0. The slopes of the curves on the high energy side of the peaks increase with increasing primary voltages, becoming discontinuous at a point which, within experimental error, corresponds to the primary energy. On the low energy end the peaks decrease less rapidly, reaching half-maximum values around 0·3 eV_0 for voltages up to 10 kV and around 0·5 eV_0 for the higher primary voltages. The curves have a shape similar to that of the continuous X-ray spectrum curves. AUTHOR.

756. Large Angle Scattering of Electrons in Gases. Part II. C. B. O. Mohr and F. H. Nicoll. *Roy. Soc., Proc.* 138. *pp.* 469–478, *Nov.* 1, 1932.—Using the method previously described [see Abstract 380 (1933)], the angular distribution of slow ($\ngtr$150 volts) electrons scattered elastically and inelastically in H_2, CH_4, N_2, Ne and CO_2, and elastically in PH_3, SH_2 and A have been determined between 40° and 160°. The energy losses in H_2, CO_2, N_2 and Ne are respectively 12·6, 12·9, 12·8, and 16·6 corresponding to excitation to the $2^1\Pi$ and 2^1P levels.

Results for H_2, CH_4, N_2 and Ne resembled those previously obtained [see Abstracts 1356 and 4557 (1932)], those for CH_4, N_2 and Ne for elastic scattering are very similar *inter se*. The intensity of inelastic scattering at large angles for H_2, CO_2 and N_2 is 0·10–0·05 of that of elastic scattering, for Ne 0·02, the curves being similar. PH_3, SH_2 and A show similar curves *inter se*, with two minima and a maximum at about 100°, due probably to P and S, showing the similarity of, but gradual change in such curves for neighbouring elements in the periodic table. The connection between " size " of the atom and these results previously discussed is shown to be applicable to those now obtained. C. A. S.

757. Inelastic Collisions of Fast Electrons. O. Klemperer. *Ann. d. Physik*, 15. 4. *pp*. 361–394, *Nov*., 1932.—Using an improved form of the point counter apparatus, previously described by the author [see Abstract 1991 (1930)], for the investigation of single scattering of fast electrons by thin foils, the inelastic scattering is examined. Primary electrons having energies of 30 kV and 45 kV are used; the thickness of the celluloid films is varied from 900–2000 Å. The scattered electrons form two groups, one homogeneous in velocity and due to elastic scattering, the other inhomogeneous in velocity and due to inelastic scattering. The inelastic scattering at 45° is determined by subtraction of the known elastic scattering from the total observed scattering. The velocity of this inelastically scattered group is approximately equal to the cosine of the angle of scattering multiplied by the primary velocity of the electrons. Quantitative investigation of the inelastic scattering at 45° confirms the predictions of quantum mechanics as opposed to those of classical mechanics. Inelastic scattering at angles greater than 90° is demonstrated and explained as due to double scattering (inelastic scattering with subsequent deflection by the nucleus). When scattering foils of Be, Al and Ni are used, no satisfactory quantitative results are obtained, the peak for the inelastic scattering not being resolved. F. C. C.

758. Quantum Theory of the Diffusion of Electrons. L. Goldstein. *Comptes Rendus*, 195. *pp*. 864–866, *Nov*. 14, 1932.—The rôle played by so-called *external* shock in the diffusion of electrons owing to collision with atoms is briefly discussed. [See also following Abstract.] J. S. G. T.

759. Conservation of Momentum in the Processes of Electronic Impacts. L. Goldstein. *Comptes Rendus*, 195. *pp*. 999–1002, *Nov*. 28, 1932.—In correction of conclusions deduced in a previous note [see preceding Abstract] the author deduces an equation indicating the extent to which, in accordance with wave-mechanics, momentum is concerned in electronic impacts. J. S. G. T.

760. Diffraction of Fast Protons by Gold Foil. E. Rupp. *Zeits. f. Physik*, 78. 11–12. *pp*. 722–727, *Oct*. 28, 1932.—Photographs of the Debye-Scherrer diffraction pattern for 200-kV protons traversing very thin gold foils were obtained and the diameters of the four diffraction rings forming the pattern were determined. The de Broglie wave-length of the proton computed from each of the measured diameters agreed to within 2 % with the value derived from the accelerating voltage (200 kV). From the intensities of the diffraction rings, the atom form factor for protons was evaluated and compared with that for fast electrons. The shape of the atom form factor curve was found to correspond within 10 % (the experimental error) to Rutherford's scattering law. W. S. S.

761. Diffraction Experiments with Slow Electrons. A. Bühl. *Phys. Zeits.* 33. *pp.* 842–844, *Nov.* 1, 1932.—To avoid the long exposures required in the Debye-Scherrer powder method for obtaining diffraction patterns due to slow electrons, an electrical method of recording is devised, the different diffracted groups of electrons being focussed by means of a uniform longitudinal magnetic field into a Faraday cylinder connected to an electrometer. Good results are obtained with Ag as scatterer; the energies of the electrons are varied up to 220 volts, while the magnetic field is altered over the range from 50 to 100 gauss. F. C. C.

See also Abstracts 556, 581, 644, 693, 702, 708, 711.

ELECTROSTATICS.

762. Migration of Dust Particles in Electric Filters. G. Mierdel. *Zeits. f. techn. Physik*, 13. 11. *pp.* 564–567, 1932. *Phys. Zeits.* 33. *pp.* 823–824, *Nov.* 1, 1932.—Studies the behaviour of ions, particularly in "tube filters." They are metallic tubes about 25 cm. in dia. and several metres in length, along the axis of which a wire charged to some 60 volts is fixed, while the tube itself is earthed. The air to be cleaned is made to stream along the tube with a speed of 1 to 3 m./sec. The author determines the migration velocity for nuclei of various sizes, and finds them to range from 89 cm./sec. for particles of 60 to 75 μ to 4·9 cm./sec. for particles of 0·2 μ. These velocities correspond so closely to theory that it is unnecessary to assume any action beyond the ordinary electrostatic action in calculating the efficiency of the apparatus. E. E. F. d'A.

See also Abstracts 470, 547.

GALVANOMAGNETIC AND THERMOMAGNETIC EFFECTS.

See Abstract 774.

MAGNETISM AND ELECTROMAGNETISM.

763. Generalisations of Maxwell's Theory. Irene E. Viney. *Phil. Mag.* 14. *pp.* 961–976, *Nov.*, 1932. *Supplement.*—Various modifications of Maxwell's electromagnetic theory, put forward with a view to obtaining agreement with quantum mechanics, are criticised and shown to lead to the denial of the conservation of charge, energy and momentum, amongst other difficulties. G. C. McV.

764. Weiss Molecular Field. K. Honda. *Tohoku Univ., Sci. and Technol. Reports*, 21. *pp.* 332–343, *Oct.*, 1932. *In English. Report No.* 291 *from the Research Inst. for Iron, Steel and other Metals.*—A criticism of the Weiss theory of spontaneous magnetisation and also the theoretical aspect regarding the abnormal change of specific heat in the neighbourhood of the critical point. The author, supporting the theory of ferromagnetism proposed by Okubo and himself, states that whilst in the case of Weiss the extremely strong molecular field is assumed, in his case the mutual magnetic action between neighbouring poles only is taken into account. On various grounds quoted in the paper the author infers that the Weiss theories quoted initially are untenable from the viewpoint of the molecular field. The magnetocaloric effect can be explained from thermodynamic principles without assuming a molecular field, and the existence of the latter as a magnetic quantity is not considered by the author as being in agreement with observed facts. If the field is non-magnetic, then Weiss's theories are invalid as quoted above. S. G. B.

V. 19

765. Propagation of Large Barkhausen Discontinuities. Part II. K. J. Sixtus and L. Tonks. *Phys. Rev.* 42. *pp.* 419–435, *Nov.* 1, 1932.—A new formula for the penetration time of large Barkhausen discontinuities is given which is based on definite assumptions regarding the condition for magnetic reversal. In order to bring this formula into agreement with experimental results, it must be modified by the introduction of a length of 0·035 cm. of unknown origin. The modified formula agrees well with the results observed for wires of various diameters, a strip for various impressed fields, tensions and torsions, and for variations of jump magnitude and electrical resistivity. The behaviour of the discontinuity in a 15 % NiFe wire relative to heat treatment was investigated. Changes in critical (minimum propagating) and coercive fields were indicative of the internal state of strain in the wire. The presence of cold-work strains appears to be necessary for the occurrence of the jump, but the addition of strains arising from cooling through the γ-α transformation reduces the tendency to form the large discontinuity. Propagation was observed at temperatures up to 350° C. With increasing temperature the slope A of the v-H curves increased. At the same time the range between the critical field and the field at which propagation starts spontaneously at some point in the wire decreased. Etching the surface of a wire also increased A and decreased propagation range. Cracks appearing in the wire surface indicated that the release of surface strains may well have been responsible. It was established that neither the removal of material nor the absorption of hydrogen were the cause. [See also Abstracts 3234 (1931) and 2132 (1932).] AUTHORS.

766. Time Phenomena, Creation and Stabilisation of Large Magnetic Effects or Discontinuities. F. Hülster. *Zeits. f. techn. Physik*, 13. 11. *pp.* 516–531, *and* 13. 12. *p.* 618, 1932.—Two methods are employed for the measurement of magnetic effects or discontinuities over periods of time, namely, the Joubert disc, and a photographic registration method. The development of the Barkhausen effect is closely followed by means of the apparatus described, and curves are obtained of the value of the effect against time. The time of creation of the effect is defined and measured. The disturbance of the time of creation by small overstepping or excesses over the critical field strength are observed, and it is found that such disturbances are not following any definite rule, but that definite times are favourable for the full realisation of the effects thus caused. In the second part of the paper details are given of methods of stabilisation of the large magnetisation discontinuities. The employment of such effects or causes of discontinuity in magnetisation serves a negative purpose as regards the hysteresis loops. Diagrams and experimental details are fully given. S. G. B.

767. Permeability of Iron at Ultra-Radio Frequencies. J. B. Hoag and H. Jones. *Phys. Rev.* 42. *pp.* 571–576, *Nov.* 15, 1932.—Measurements have been made by the self-inductance method at ultra-radio frequencies of the " initial " magnetic permeability of iron wire by use of the new frequency determination method of Hoag. The following values have been obtained: 30·31, 22·10, 18·69 and 9·65 at frequencies of 469·8, 589·8, 829·8 and 1350 megacycles, respectively, corresponding to wave-lengths of 63·81, 50·83, 36·13 and 22·21 cm. These values of permeability are appreciably lower than those of Arkadiew in this region, but show a similar decrease with increase of frequency. AUTHORS.

768. Magnetic Susceptibility of Binary Mixtures of Liquids. K. Kido. *Tohoku Univ., Sci. Reports.* 21. *pp.* 385–393, *Oct.,* 1932. *In English.*—The liquids tested were mixtures of water with ethyl alcohol, methyl alcohol, acetone and formic acid respectively, benzene with ethyl alcohol and acetone, and stannic chloride with acetic acid and formic acid. The susceptibilities were measured for various concentrations of the constituent liquids, and in every case the specific susceptibility was found to vary linearly with the weight concentration. It was concluded that the diamagnetic susceptibility is not influenced either by association or by the formation of a compound. G. E. A.

769. Theory of the Alteration in the Magnetism of Free Electrons Caused by Hydrostatic Pressure. T. Takéuchi. *Phys. Math. Soc., Japan, Proc.* 14. *pp.* 522–523, *Oct.,* 1932. *In German.*—The suggestion of K. Honda and Y. Shimizu that the diamagnetism and paramagnetism of metals decrease under the influence of cold working is theoretically investigated in the present paper, by means of a consideration of the alteration of the magnetism in metals created by simultaneous pressure upon all sides. For many metals, according to the results deduced, an increase of dia- and paramagnetism is theoretically expected as the consequence of such treatment as is outlined above. S. G. B.

770. Diamagnetism and Paramagnetism of the Metals. E. Vogt. *Phys. Zeits.* 33. *pp.* 864–869, *Nov.* 15, 1932.—A critical review of present-day knowledge of the magnetic properties of elementary metals concluding with a discussion of the magnetic behaviour of mixed crystals formed by gold with Fe, Ni, Pd and Pt. G. E. A.

771. Moments of Paramagnetic Ions in Salt Solutions. H. Auer. *Phys. Zeits.* 33. *pp.* 869–872, *Nov.,* 1932.—A systematic investigation into the method of determination and modes of calculation of atomic moments. The experimental method hitherto used has been, almost entirely, Quincke's hydrostatic method, and in connection with this it has already been shown that the surface tension does not change in fields up to 20,000 gauss [see Abstract 1436 (1931)]. The author concludes that magnetic investigations on salt solutions provide a very sensitive index of internal molecular reactions. For this reason, results for moments of free ions, obtained by extrapolation, must be regarded with grave doubt. If such simple salts as NaCl exhibit susceptibility effects due to these reactions, much greater effects must be expected in salts of the iron group which are common examples of internal reaction and complex structure. G. E. A.

772. Magnetisation of Paramagnetic Crystals in Alternating Fields. I. Waller. *Zeits. f. Physik,* 79. 5–6. *pp.* 370–388, *Nov.* 26, 1932.—A theoretical treatment of two cases embraced under the title. Case I.—Where the external field is so weak that the energy of the magnetic orientation of an atom (V_0) in the external field is very small compared with the magnetic energy of the alternating effect (U_0) of neighbouring magnetic atoms, *i.e.,* $V_0 < U_0$. Case II.—The external magnetic field is so strong that the reverse occurs to Case I, *i.e.,* $V_0 > U_0$. The investigation of the first case cited above leads to general conclusions and considerations of the conditions existing for the establishment of the static equilibrium. For the critical frequency of the alternating field an expression is deduced relating the various factors involved to the Planck constant. The treatment shows that in Case I an expression is deduced of comparative simplicity, but in Case II, for strong fields, very complicated formulæ ensue. S. G. B.

773. Diamagnetic Susceptibilities of Some Sulphur Compounds. J. Farquharson. *Phil. Mag.* 14. *pp.* 1003–1012, *Nov.*, 1932. *Supplement.*—The susceptibilities of SO_3, H_2SO_4, $KHSO_4$, K_2SO_4, $K_2S_2O_3$, $K_2S_2O_7$, $K_2S_2O_8$ and $K_2S_4O_6$ are recorded. The percentage differences between the experimental values and the theoretical ionic susceptibilities calculated for the ions by Pauling's and Slater's methods are concordant. The changes of diamagnetism resulting from chemical change, *i.e.*, re-arrangement or the formation of a new bond, are in accordance with theory. Comparison of results obtained with compounds of similar molecular structure, in conjunction with the theoretical susceptibilities, is used to determine the relative polarities of the H-O, K-O, S-O and S-S bonds. H. F. G.

774. Passage of an Alternating Current through a Ferromagnetic Wire under Torsion. G. Valle. *Accad. Sci. Torino, Atti,* 67. 11–13. *pp.* 319–338, 1931–1932.—Describes the induction effect produced by the passage of an alternating current along a wire of iron or steel stretched along the axis of a coil. The effect, revealed by a powerful amplifier and studied by means of the oscillograph, can be traced to asymmetry of the earth's magnetic field, or to a twist in the wire. The author has also discovered a reverse effect, the production of an impulsive e.m.f. at the ends of the ferromagnetic wire with every inversion of an alternating current circulating in the coil. E. E. F. d'A.

775. After-Effect Losses in Ferromagnetic Materials with Weak Alternating Fields. R. Goldschmidt. *Zeits. f. techn. Physik*, 13. 11. *pp.* 534–539, 1932.—Ferromagnetic materials exhibit losses other than those ordinarily attributed to eddy-currents and hysteresis when placed in an alternating field, and in weak fields these additional losses are particularly evident. According to Jordan they are characterised as "after-effect losses." The paper shows that such losses can under certain conditions considerably exceed the eddy-current and hysteresis losses, and the relationship to frequency and temperature is sought. The Wagner-Debye relationships of dielectrics are to a large extent similar in character, and these facts are kept in mind in the present study. The conclusions are enumerated in six statements based thereon. S. G. B.

776. System Equivalent to a System of Two Circuits Coupled Inductively. C. Rimini. *N. Cimento*, 9. *pp.* 240–250, *Aug.-Sept.-Oct.*, 1932.—The so-called equivalent circuit of a static transformer is by a generalisation extended to the case of any two circuits whatever coupled inductively. A mathematical investigation is given, and to complete the definition of the elements constituting the equivalent circuit it is suggested that the resistances and reactances considered should all be reduced in terms of one of the coils, all to the primary or all to the secondary. This reduction is easily effected by bringing in the ratio between the number of turns N_1 and N_2 of the two circuits. The tensions, currents, impedances (and hence the resistances and reactances) of the circuit 2 are reduced to the circuit 1 by multiplying the actual values by N_1/N_2, N_2/N_1 and N_1^2/N_2^2 respectively. J. J. S.

777. Quantitative Valuation of the Matteucci Effect. H. Ostermann and F. v. Schmoller. *Zeits. f. Physik,* 78. 9–10. *pp.* 690–696, *Oct.* 18, 1932.—The Matteucci effect—e.m.f. at the ends of a twisted ferromagnetic wire on change of magnetisation—exhibits two phases of opposite sign on the same branch of the magnetisation curve. Both can be explained as induction due to change of the circular component of the magnetisation produced by torsion. Longitudinal tension and torsion processes lead thus to opposite signs. From a quantitative determination on twisted nickel wires there follows a fixing of the magnetisation vector in the small diagonal of an element deformed by thrust. [See following Abstract.] J. J. S.

778. Induction Effect at the Ends of a Twisted Ferromagnetic Wire. W. Schütz. *Zeits. f. Physik,* 78. 9–10. *pp.* 697–703, *Oct.* 18, 1932. Proceeding from Becker's theory of the magnetisation curve an explanation is given of the induction effect measured at the ends of a twisted wire on its magnetisation. This induction effect is according to recent experimental investigations [see preceding Abstract] more complicated than the observations hitherto known would indicate. The interpretation given affords a noteworthy touchstone for the physical reality of the vector scheme that, basing its claim on the material of the theory about the course of magnetisation, explains the solution as to be found in tension and torsion processes. The quantitative results of investigation lead to a disagreement with the theory. J. J. S.

779. Magneto-Mechanical Effect. N. Akulov and E. Kondorsky. *Zeits. f. Physik,* 78. 11–12. *pp.* 801–807, *Oct.* 28, 1932.—The distribution function of the spin axes in elastically deformed single crystals is evaluated as a function of the applied field and the tension. The results obtained are employed to calculate the magnetostriction of the crystal for any direction of tension and field relative to the crystal axes. The possibility of a change in length in a ferromagnetic consequent on a reorientation of the spins under the influence of the elastic strain—an effect which may also take place in the absence of an external field—is confirmed (mechanostriction). It follows that Hooke's law is not strictly applicable to ferromagnetics. The ΔE effect is explained as due to the lessening of the mechanostriction with the magnetisation. G. E. A.

780. Effect of Elastic Strain on the Magnetisation Curve. N. Akulov, A. Helfenbein and N. Byczkov. *Zeits. f. Physik,* 78. 11–12. *pp.* 808–814, *Oct.* 28, 1932.—The course of the magnetisation curve for elastically-strained ferromagnetics with weak magnetisation is investigated theoretically and experimentally, and a general relation for the susceptibility as a function of the tension is established. This relation shows that the initial susceptibility α increases or diminishes with the tensile stress F according as the magnetostriction for weak magnetisation is positive or negative, and also that the second derivative of $1/\alpha$ with respect to F is always positive. G. E. A.

781. Magnetostriction of Iron-Cobalt Alloys. Y. Masiyama. *Tohoku Univ., Sci. Reports* 21. *pp.* 394–410, *Oct.,* 1932. *In English. Report No.* 294 *of the Research Inst. for Iron, Steel and other Metals.*—The measurements were made with the same apparatus as that used for the iron-nickel system [see Abstract 979 (1932)] and the results are given in numerous tables and graphs. The longitudinal effect is the reverse of that found for pure iron. For alloys of 10 to 70 % Co there is a rapid expansion in weak fields followed by a slow increase as the field increases, the effect being greatest for 70 % Co. With 90 % Co contraction is first observed which changes to expansion for fields above 400 gauss. The transverse effect is opposite to the longitudinal effect, and the volume change is a differential effect of the first two. A marked discontinuous change in the expansion-concentration curve takes place in the vicinity of 80 % Co corresponding to the phase change from an α to a γ solid solution.

G. E. A.

782. Tension/Extension Diagram of Ferromagnetic Materials for Very Small Loads. H. Kühlewein. *Zeits. f. techn. Physik,* 13. 11. *pp.* 539–540, 1932.—The tension/extension or load/extension curves are obtained for different materials, and the elastic after-effects are observed. Cu, Ni, etc., are treated. The results show that for ferromagnetic materials under tension, the tension as indicated by the magnetostriction comes to rest after several minutes, *i.e.,* does not immediately assume equilibrium after application or removal of the load. The conclusion is made that the long duration magnetic after-effects, not due to eddy-currents or otherwise, are identical with the described and well-known elastic after-effects, and have no other origin.

S. G. B.

783. Joule Magnetostrictive Effect in Cobalt-Iron Alloys. S. R. Williams. *Rev. Sci. Instruments,* 3. *pp.* 675–683, *Nov.,* 1932.—In the course of studying various ferromagnetic rods, a group was found which showed a wide variation in the type and magnitude of the changes in length which occur when they were magnetised longitudinally. This collection included rods of iron, nickel, cobalt and alloys of cobalt-iron. In a later paper it is proposed to correlate the final results in this paper with the mechanical hardness, elastic properties, hysteresis loss and change in resistance due to a magnetic field. In making the following study a new extensometer and recording camera were used. These are described.

AUTHOR.

784. Torsional Magnetisation. H. Brion. *Ann. d. Physik,* 15. 2. *pp.* 167–197, *Nov.,* 1932.—The natural magnetisation of ferromagnetic materials follows the rule that initially it passes through a reversible region and then passes on to an irreversible state. The point of maximum steepness of the curve corresponds to the maximum of the irreversible phenomena. The Barkhausen effect is likewise and in fact may be regarded as a measure of the irreversible effects. Lastly comes the range of saturation where the Barkhausen effect disappears. In the case of magnetisation by torsion or orientation in a magnetic field of a disc by rotation, the phenomena created are analogous. It is known that the loss is proportional to the field-strength from zero up to a maximum, and then after saturation strongly diminishes until finally it becomes asymptotic to the zero axis. The loss can be explained on the basis that an angle is established between the field and the induction by the orientation of the disc, and Cismann found a limiting value for the angle of rotation of the disc within which the Barkhausen effect is not apparent. This angle is believed to be identical with the angle of lag between field and induction. Extending the work of Cismann in the present paper, the author sets out to answer the three questions: (1) Is the position of the coil an influencing factor upon the Barkhausen effect? (2) Does the greatest steepness of the magnetisation curve correspond with the maximum effect? (3) Is the maximum of the loss corresponding to the maximum of the effect? Full details are given of a new apparatus for the investigation of the Barkhausen effect to answer these queries. The Barkhausen effect was determined as being definitely dependent upon the direction as is shown by hysteresis in the torsion effect. By means of a rotating coil this was demonstrated, as also that when plotted against the angle of rotation the Barkhausen effect gives a sine curve. According as the axis of the coil is parallel to or at right angles to the field, is the minimum or maximum of the angle of lag created. This angle is greater than the Cismann angle of limitation, which is also dependent upon the field-strength. The relationship between the maximum and minimum values of the Barkhausen sine curve described above varies for different materials, and the ratio is a measure of the variation of the Barkhausen effect with the angle of torsion or rotation. For nickel it is small, and for iron great. The loss and the Barkhausen effect maxima do not coincide. The paper is lengthy and detailed. S. G. B.

785. Vibration Galvanometer Independent of Frequency. W. Meissner and U. Adelsberger. *Zeits f. techn. Physik,* 13. 10. *pp.* 475–477, 1932. *From the Reichsanstalt.*—Describes a new vibration galvanometer, better than the earlier one due to the same authors [Abstract 2927 (1930)], which gives deflections independent of frequency over a certain range. The instrument uses both a d.c. and an a.c. magnet, and the needle itself is of special form with very little air damping and a small moment of inertia. By the use of 36 % cobalt steel, the magnetic moment is kept very high. Interchangeable suspended systems are provided for frequency ranges 15 to 400, 396 to 670 and 670 to 820 ∼ respectively. A further paper is promised, dealing with the theory, especially as regards the interaction between the instrument and the generator. J. H. A.

786. Resonant Shunt Damping in Oscillographs. E. J. Martin and D. F. Carls. *Rev. Sci. Instruments,* 3. *pp.* 598–615, *Oct.,* 1932.—The useful frequency range of oscillographs can be increased by the use of resonant shunts instead of fluid damping. A discussion of the theoretical work on this subject shows definitely what conditions must be satisfied in order to obtain damping with a resonant shunt. Resonant shunt damping is not a dissipation of energy as in fluid damping. The deflection of the element is not a measure of the current actually passing through it. An experimental study of resonant shunt damping as applied to a special insensitive element shows clearly how the damping is brought about. A simplified application to bifilar elements is described and demonstrated. The bifilar element is regarded as two single-string elements in series with mass coupling. E. E. F. d'A.

787. Reversing and Short-Circuiting Switch for Hysteresis Measurements. A. W. Smith. *Journ. Sci. Instruments,* 3. *pp.* 626–631, *Oct.,* 1932.—A switch for hysteresis measurements is made by building an additional jaw at each end of the usual double-pole, double-throw reversing switch. After reversing the current, one of the switch blades enters the added jaw, thereby short-circuiting an adjustable part of the circuit and increasing the current to its fixed maximum value. This makes it possible to stop at any chosen point on the hysteresis curve, and to carry the steel in a single step from this point to one tip of the hysteresis loop. A ratchet and pawl on the handle of the switch insures that the steel is carried through the complete hysteresis cycle each time. AUTHOR.

788. Three Superfluous Systems of Electromagnetic Units. G. A. Campbell. *Physics,* 3. *pp.* 230–239, *Nov.,* 1932.—At the present time the electromagnetic, electrostatic, Heaviside-Lorentz, practical and international systems of electric and magnetic units are used side by side in pure and applied electromagnetism. The question is here raised whether the use of this multiplicity of units should continue indefinitely into the future when the conversion tables for translating from any system to any other system show the essential equivalence of all five systems. It is recommended that only one system should be legalised and used generally in place of the five systems, and that this universal system should be the coherent metre-kilogramme-second-ohm or definitive system. It is further recommended that the international ohm should be used in this system. This unit is the one actually used in exploring the physical world because laboratory resistances for physics and test-room resistances for engineering have been so calibrated. Of far greater importance is the fact that by retaining the international ohm it will be simpler, and completely feasible, to eliminate what Heaviside called " that unmitigated nuisance, the 4π factor of the present B.A. units " from our preferred system of units.

AUTHOR.

See also Abstracts 544, 545.

MEDICAL RADIOLOGY AND ELECTROLOGY.

789. Classification of Ions in Natural Chemical Grouping According to their Vaso-Motive Action in Respect to Trans-Cerebral Electrolysis. G. Bourguignon and S. Eliopoulos. *Comptes Rendus,* 195. *pp.* 976–978, *Nov.* 21, 1932.—The authors have shown that the trans-cerebral dielectrolysis of chlorine, iodine, calcium and magnesium is a measure, in the human subject, of the variation of the oscillometric index and also have demonstrated the existence of vaso-motor cerebral centres. In this relation the potassium ion is inactive. In the present paper the authors classify further elements, both metal and metalloid, and these fall into an active and a non-active group, and a relationship is present in relation to the chemical grouping. In conclusion, the authors state that the action of the ions is greater in the pathological than in the non-pathological brain, the action is dependent on the chemical group and, in the same group, increases with increase of atomic weight. Only magnesium and iron increase the arterial pressure, as well as the oscillometric index. It is remarkable that the physiological classification of the element corresponds with the physiochemical properties. B. J. L.

790. Short-Wave H.F. Currents. Their Heating Effects—Short-Wave Diathermy. H. H. U. Cross. *Electrician,* 109. *pp.* 683–684, *Nov.* 25, 1932.—It has long been known that the heat effects of h.f. currents do not apparently obey the law of Joule. In medical diathermy, ammeter measurements are unreliable, the only safe indication being the patient's own sensation. Pyrometric indication is suitable when the apparatus is used in an orifice, but not with surface electrodes, and, in any case, its high cost prevents its application. Owing to variations of sensation in different patients, with respect to heat and cold, burns may occur. The author then discusses the distribution of the potential field between electrodes as used in practice and the difference between continuous and intermittent wave trains, as provided by valve and quenched-spark diathermy apparatus. With very short wave-lengths of 15 to 20 metres, electrodes are not actually applied to the patient, who is situated between two insulated discs. As a result, one part of the current passes outside the patient as a displacement current and another part passes *via* the patient's tissue, according to the nature of the tissue, either by a displacement current or convection currents due to ions. The effects produced are essentially capacity effects. The circuit of a 1-kW short-wave apparatus of this type used in practice to produce artificial fever is shown. B. J. L.

791. H.T. Voltmeter for the Direct Measurement of Tube Voltage during Diagnosis and Therapy. K. W. Müller. *Fortschritte a.d. Gebiete der Röntgenstrahlen, Feb.*, 1932. *Brit. J. of Radiology*, 5. *pp.* 780–783, *Oct.*, 1932. *Abstract.*—The method is based on the determination of the electrical charge of a condenser. A rectifying valve, a ballistic milliammeter and an h.t. condenser connected in series are shunted across the X-ray tube. When current is applied to the tube the condenser is charged to the peak value of the voltage by a charge which is measured by the ballistic meter. If the capacity of the condenser is known, the peak voltage can be determined by dividing the quantity of electricity by the capacity. In practice the condenser does not charge fully to the peak voltage in the case of exposures of very short duration, but the necessary corrections can readily be determined. G. E. B.

792. Quantum Physics of Biological X-Ray Action. R. Glocker. *Zeits. f. Physik*, 77. 9–10. *pp.* 653–675, *Aug.* 24, 1932.—The biological effect of X-rays has been studied by many workers, who have given a curve relating the percentage of "injured" objects to the X-ray-dose, the "injury-dose" curve being exponential. Holthusen, on the biological side, has found the curve to be more nearly a probability curve. The present paper discusses mathematically the form of the curve, making assumptions concerning the probability processes involved and making use of the quantum conditions. The final result gives an "injury-dose" curve of the form found by Holthusen, and the work is extended to embrace complete cells and to take into account the influence of biological variability. G. E. B.

See also Abstract 678.

OSCILLATIONS.

793. Wide Range Interference Wavemeter for Laboratory Use. L. Rohde and H. Schwarz. *Hochfrequenztechn. u. Elektroakustik*, 40. *pp.* 117–120, *Oct.*, 1932.—Describes a valve wavemeter capable of direct measurements over the range 6 to 3600 m. The accuracy of the instrument, which is controlled by a crystal, is about 0·01 %. Six interchangeable inductances are used, and tuning is effected by a variable condenser of 500 cm. capacity. The apparatus may also be used for measuring capacity, inductance and for investigating the performance of quartz crystals. G. E. B.

794. Method of Measuring Harmonics in H.F. Circuits. M. Osnos. *Hochfrequenztechn. u. Elektroakustik*, 40. *pp.* 121–122, *Oct.*, 1932.—Discusses a method whereby an oscillatory circuit comprising an inductance, tuning condenser and wattmeter, coupled inductively to the oscillatory circuit, may be used to measure the harmonics and express their magnitude as a fraction of the fundamental amplitude. The mathematical theory is developed, and it is shown that the required ratio may be determined from a knowledge of the oscillatory circuit constants and the power. G. E. B.

795. Rarefied Ionised Gases in H.F. Fields. A. Rostagni. *Accad. Sci. Torino, Atti*, 67. 14–15. *pp.* 531–546, 1931–1932.—A condenser is considered attached to the terminals of a Lecher-wire system in which the shocks of collision between the ions need not be taken into consideration. Shows that the results attained hitherto can be calculated on simple assumptions. [See also Abstract 2570 (1932).] E. E. F. d'A.

796. Damping of Oscillations of Very High Frequency. A. Witt. *Comptes Rendus*, 195. *pp*. 1005–1007, *Nov*. 28, 1932.—The case of a diode in series with an oscillatory circuit is investigated mathematically and the conditions are found which define the regions where damping of the h.f. oscillations occurs. A. W.

See also Abstracts 500, 678, 803.

PHOTOELECTRICITY.

797. Calculation of the Long-Wave Limit of the Photoelectric Effect from the Atomic Volume of the Element. G. Schweikert. *Zeits. f. Physik*, 79, 3–4. *pp*. 248–253, *Nov*. 14, 1932.—Using a relation obtained earlier [see Abstract 4335 (1932)] for the constant *h*, an equation is obtained for the law of black-body radiation by classical mechanics. This gives the long-wave limit of the photoelectric effect as proportional to the $\frac{2}{3}$ power of the atomic volume. Finally, some speculation is made as to the mechanism of the electronic emission. H. M. B.

798. New Photoelectric Effect. Q. Majorana. *Accad. Lincei, Atti*, 16. *pp*. 173–179, *Sept*., 1932.—In connection with the photoelectric behaviour of metallic films deposited on glass [see Abstract 5223 (1932)], the author has examined several metals. A platinum film, in series with 8 volts and a telephone, and illuminated with a mercury arc giving intermittent illumination, gives a louder sound than silver, particularly if covered with a film of lampblack. Gold and tin also gave a sound, even in the form of commercial tinfoil, but aluminium and zinc did not. The author does not lose sight of the fact that it may be a purely thermal phenomenon, but has some reasons for believing it is not. E. E. F. d'A.

799. Selective Photoelectric Effect at Thin Films of Alkali Metals. R. Suhrmann and A. Schallamach. *Zeits. f. Physik*, 79. 3–4. *pp*. 153–160, *Nov*. 14, 1932.—The selective photoelectric effect in alkali metals is largely believed to be dependent upon a thin layer separating the alkali metal from the solid metal forming the kathode. The authors show that this selectivity also occurs when the mirror is covered with an invisible film of potassium of more than monatomic thickness. Even when the silver is deposited free from residual gas by distillation in a high vacuum, the maximum is at 343 mμ. E. E. F. d'A.

800. Spectral Sensitivity of Photovoltaic Piles of Copper Electrodes Coated with Cuprous Oxide. G. Athanasiu. *Comptes Rendus*, 195. *pp*. 767–769, *Nov*. 7, 1932.—The spectral sensitivities of cuprous oxide photovoltaic cells, prepared in three different ways, are determined, and the results are discussed. The threshold of sensitivity appears to be at about 6500 Å.; with decrease of wave-length the sensitivity increases until a maximum value is attained in the region 4600–4800 Å. or 5100–5500 Å., depending on the mode of preparation of the electrodes, and thereafter decreases. The e.m.f. developed may be either positive or negative. J. S. G. T.

801. Photoelectric Conductivity of Semi-Conductors. W. Leo. *Ann. d. Physik,* 15. 2. *pp.* 129–144, *Nov.,* 1932.—In continuation of his previous paper on surface charges in semi-conductors [see Abstract 3553 (1931)], the author studies charges observed in Cu_2O and Ag_2S after the emission of heat electrons. Subsequent illumination with highly refrangible light produces an accelerated potential drop, which is, however, distinctly localised. After the surface has become charged, a displacement of the long-wave limit sets in. Near the limiting wave-length there is an increase of the effect, but below 220 m. there is a decrease. The " blocking layer " is estimated to have a capacity of approximately 5×10^{-2} μF/cm². E. E. F. d'A.

802. Becquerel Effect at Selenium Electrodes. M. Volmer and W. Moll. *Zeits. f. phys. Chem.* 161. *Abt.A.* 6. *pp.* 401–410, *Oct.,* 1932.—The selenium electrodes were formed by depositing metallic selenium on platinum and sensitising them by heat treatment. They were opposed by a lead dioxide electrode, and immersed in dilute sulphuric acid. The light effect was determined for light of 436 and 577 μμ and found to be proportional to the number of quanta absorbed. The electrochemical formation of SeH_2 accompanies the photoelectric current, the amount formed being in accordance with Faraday's law. A Becquerel effect was also found in the case of a platinum electrode covered with a thin film of sulphur. E. E. F. d'A.

803. New Selenium Light Relay. L. Bergmann. *Zeits. f. techn. Physik,* 13. 11. *pp.* 568–573, 1932. *Phys. Zeits.* 33. *pp.* 824–826, *Nov.* 1. 1932.—An intense source of light is partly made to illuminate the mirror of a galvanometer, which reflects the light on to a blocking-layer selenium cell. A portion of the beam is reflected by a plain glass plate at 45° to the axis of the beam on to a second selenium cell. A relay is actuated by the difference of the two photoelectric currents. The author also describes a d.c. amplifier with a factor of 900 and an instrument for detecting minute oscillations. E. E. F. d'A.

See also Abstracts 428, 717.

PIEZOELECTRICITY.

804. Thickness Vibration of Piezoelectric Oscillating Crystal. I. Koga. *Radio Research, Japan, Reports,* 2. *pp.* 157–173, *Sept.,* 1932. *In English.*—A theoretical investigation is given of that mode of vibration in a naturally vibrating piezoelectric oscillating crystal which has a period proportional only to the thickness. It is found that this thickness vibration of a thin piezoelectric crystal plate is due to the standing wave produced by the interference of plane waves incident on and reflected from the major plane boundary surfaces of the plate. There are three normal modes in the thickness vibration and these may or may not be sustained piezoelectrically according to the orientation of the major surfaces. In the investigation the boundary surfaces are assumed to extend to infinity. J. J. S.

805. Experimental Determination of the First Piezoelectric Modulus of Quartz. Berta Nussbaumer. *Zeits. f. Physik,* 78. 11–12. *pp.* 781–790, *Oct.* 28, 1932.—The method of Székely [see Abstract 410 (1933)] was used to determine the piezoelectric modulus d_{11} of quartz from the resonance curves of quartz resonators. Measurements with quartz rods exhibiting twinning of various kinds gave values of d_{11} much lower than were obtained with homogeneous material, for which the value found was $d_{11} = 6 \cdot 84 \times 10^{-8}$ $c_{E.S.}$/dyne. A. W.

See also Abstracts 500, 677.

THERMIONICS.

806. Kinematography of Oxide Kathodes Using the Electron Microscope. E. Brüche and H. Johannson. *Ann. d. Physik*, 15. 2. *pp.* 145–166, *Nov.*, 1932.—A device, termed an " electron microscope," is described by which the conditions of the surface of an oxide kathode may be photographed. Electrons emitted from the kathode are accelerated by a potential difference of about 650 volts maintained between the kathode and a nearby electrode which is pierced by a hole at its centre. The electrons pass through this hole and impinge upon a fluorescent screen of calcium tungstate which is placed at a distance from the screen. In this way a magnified image is produced, and this is photographed with a kinematograph outfit. The brightest parts of the image correspond to the places upon the kathode at which the emission of electrons is most intense. The following results are obtained: (1) the emission moves backwards and forwards between the activated regions and regions at which craters have been artificially formed in the active material; (2) the presence of marked quantities of gas in the vessel produces sharply-marked emission free regions; (3) by strongly overheating the kathode the active surface degenerates into strongly emitting centres which change their position so rapidly that a scintillating effect is produced. The conditions which govern (1) are investigated and discussed. A number of photographs accompany the paper. J. E. R. C.

807. New Investigations of Kathodes with the Electron Microscope. E. Brüche and H. Johannson. *Phys. Zeits.* 33. *pp.* 898–899, *Nov.* 15, 1932.—The authors have devised a combined electric and magnetic deflection method which gives electron-optical enlargements of emitting surfaces, with magnifications ranging from ×60 to ×150. The detailed description of the experiments is postponed, but a plate showing electron pictures of tungsten and thoriated tungsten kathodes is reproduced and described. The pictures for thoriated tungsten show different stages of activation and deactivation. The phenomena observed with the electron microscope in the case of thoriated tungsten suggest that capillary forces play an important part in the various changes the surface undergoes. W. S. S.

808. Diffusion of Positive Ions through Hot Copper. J. Cichocki. *J. de Physique et le Radium*, 3. *pp.* 478–485, *Oct.*, 1932.—Continues the work of Peczalski and Cichocki on the diffusion of salt vapours through hot metals [see Abstract 2806 (1929)] by analysing the ions emitted by the metal by means of a mass spectrograph. The salts dealt with are the chlorides of the metals of the alkalies and alkaline earths, as well as Mg, Cu, Ni and Al. The author puts forward the theory that the positive ions emitted by the salt are capable of penetrating the space lattice of the copper and producing modifications therein, leading to cementation and glass-like fragility. The initial spectrograms show a large amount of O_2 ions, which are probably the active agent in facilitating the discharge of oxide-coated kathodes. E. E. F. d'A.

809. Emission of Positive Ions from Heated Metals. LeR. L. Barnes. *Phys. Rev.* 42. *pp.* 487–491, *Nov.* 15, 1932.—The positive ion emission from iron, nickel, copper, rhodium, columbium, platinum, uranium and thorium has been studied. In addition to the emission of singly charged atoms of the alkalies, reported by others, it is found that iron, nickel, copper, rhodium and columbium emit singly charged atoms of their own metals. The results from rhodium and columbium are in agreement with those already reported by H. B. Wahlin [*Phys. Rev.* 37, *p.* 467, 1931]. AUTHOR.

810. Temperature Variation of the Positive Ion Emission from Molybdenum. LeR. L. Barnes. *Phys. Rev.* 42. *pp.* 492–497, *Nov.* 15, 1932.—The temperature variation of the positive ion emission from aged molybdenum filaments was studied with two different types of tube. The values for the positive ion work function and for the reflection coefficient for molybdenum ions are found to be in better agreement with the theory of positive ion emission presented by L. P. Smith [see Abstract 2643 (1930)] than were his experimental results on molybdenum ions. AUTHOR.

811. Effect of Ammonia on Positive Ion Emissivity of Iron, Nickel and Platinum. A. K. Brewer. *Am. Chem. Soc., J.* 54. *pp.* 4588–4597, *Dec.*, 1932.—Results are given showing the effect of NH_3, N_2 and H_2 on the thermionic emission of positive ions from Fe, Ni and Pt. The surprising fact appears that at low temperatures a pure iron filament in NH_3 emits positive ions more copiously than even the best of potassium-impregnated positive ion sources. Ni also is only slightly less efficient than Fe, but the positive ion current from Pt is not materially increased. H has an appreciable enhancing effect on Pt and Ni for both positive and negative thermions. N, however, shows only a slight effect with Fe and Ni, and none with Pt. The mechanism by which positive adions lower the work function for electrons and enhance the emissivity for positive ions is described. Work function values for NH_3 on Fe indicate that the ion is emitted from a point $1 \cdot 9 \times 10^{-8}$ cm. from the surface. Since this distance is approximately equal to the radius of the NH_3 molecule it would appear that ions before emission resided on the surface in the completely dissociated state. The bearing of these results on adsorption and surface catalysis is briefly discussed. A. W.

See also Abstracts 695, 717, 803.

THERMOELECTRICITY.

812. Thermoelectric Power of Multiple Oxides. F. Fischer, K. Dehn and H. Sustmann. *Ann. d. Physik,* 15. 1. *pp.* 109–126, *Oct.*, 1932.—Determine the effect of mixing several different oxides, up to the number of five, pressing them into a tablet, and measuring its thermo-e.m.f. against a standard substance. They find that the effect is not what might be expected from the law of mixtures, but that in some cases a considerably enhanced e.m.f. results. Thus, a mixture of CdO with 5 % MgO was capable of yielding 0·215 watt per °C. with NCT_3 steel, while a mixture of Co_3O_4 with 10 % CuO, 5 % Bi_2O_3, 2 % Ta_2O_5 and 2 % MgO yielded as much as 164 mV for a difference of temperature of 700° C. The authors cannot yet state how much of the effect is due to a reduction of the resistance and how much is purely thermoelectric. E. E. F. d'A.

See also Abstracts 717, 723.